

# **AN ASSESSMENT OF THE VIABILITY OF LABOUR INTENSIVE TOWNSHIP DEVELOPMENT IN THE CAPE METROPOLITAN AREA**

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## ABSTRACT

Labour intensive construction, generally defined by authors as the economically efficient use of labour to produce the quality of product as demanded by the specification (and allowed by the funding available), ensures that significantly more labour is used per unit of expenditure than in conventional construction. Labour intensive municipal infrastructure projects have been implemented in South Africa since 1985, but it is only in recent years that large township development projects in the Cape Metropolitan Area were undertaken with a purposeful exchange of machines for people.

This thesis aims to assess the viability of labour intensive construction methods when applied in township development in the Cape Metropolitan Area. Case study methodology was used to design the study and gather and analyse data to reach meaningful conclusions. Six cases where labour intensive construction methods are used to provide municipal services, were investigated. After analysis, the findings were synthesised and recommendations presented.

The objectives of the thesis were to investigate the factors; cost, time and quality when labour intensive construction methods are used. Contractual arrangements, possible social benefits and communication were also identified as areas to be investigated. The findings were compared with the industry's norms for conventional construction methods in order to evaluate the viability of labour intensive construction.

Selected publications which are relevant to labour intensive construction were reviewed. Aspects covered in the literature and identified in the objectives have been summarised and salient points highlighted. The objectives of the thesis could, however, not be met with the data gathered during this review.

Utilising a data collection design prescribed by the case study methodology, data

were gathered from each case and summarised as individual reports. The six cases included projects recently completed or in progress. Data collection and compilation of case reports followed the study's questions. These questions, in turn, were designed to address the mentioned objectives. After analysis, the results were compared to the industry's norms for conventional construction.

The main conclusions drawn from the review and investigation were that:

- a) the technical issues - contractual arrangements, quality and timing - have been and are, adequately dealt with. One exception is the tender evaluation process which has to be reviewed and finalised
- b) labour intensive projects cost in the order of 10 - 15% more than conventional projects
- c) the success of labour intensive projects depends to a large extent on the social structure in a local community. Where the community is not well represented by the leader group, breakdowns in communication are experienced with resulting extension of contract periods and increase in costs
- d) in township development only approximately 11% of total project costs are currently allocated to local labour. This relative low figure indicates that township development is not the ideal type of development where labour intensive construction methods can be employed
- e) only in cases where all controllable and uncontrollable factors are conducive to labour intensive construction methods, can this construction method be viable

The more important recommendations for future consideration which flowed from this investigation are:

- a) a well-planned monitoring system should be established
- b) a pre-feasibility study should be undertaken for each identified project
- c) guidelines for establishing the degree of labour-intensity should be finalised
- d) all subjectivity must be removed from the tender evaluation process

- e) community liaison around labour related issues must be handled solely by the contractor
- f) projects should be identified, where possible, to lend itself to either one of the construction methods

## **GLOSSARY**

Person-task	-	The measure of work that can be done by an average man in one day working at an acceptable rate of work
Task-rate	-	The wage paid per task-rate
Premium	-	The amount that a Labour Intensive Project costs more than a Conventional Project
Direct Cost	-	Cost of material, labour, machines, etc. on a project
Indirect Cost	-	Cost of consultant fees, surveys, investigations and other services associated with a project



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## **ABBREVIATIONS AND ACRONYMS**

<b>ABLIC</b>	-	Accreditation Board for Labour Intensive Construction
<b>CMA</b>	-	Cape Metropolitan Area
<b>COSATU</b>	-	Congress of South African Trade Unions
<b>DBSA</b>	-	Development Bank of Southern Africa
<b>DOT</b>	-	Department of Transport
<b>IDT</b>	-	Independent Development Trust
<b>LIC</b>	-	Labour Intensive Construction
<b>NCLIC</b>	-	National Committee for Labour Intensive Construction
<b>RDP</b>	-	Reconstruction and Development Program
<b>RKDP</b>	-	RSA/Kwazulu Development Project
<b>SABITA</b>	-	South African Bitumen and Tar Association
<b>WCUSA</b>	-	Western Cape United Squatters Association

# **1. INTRODUCTION**

## **1.1 BACKGROUND TO THE STUDY**

The World Bank and the International Labour Organisation carried out research on the substitution of labour for equipment in civil construction as early as 1971. Their findings supported the theory that labour can be substituted for equipment in civil construction, and the first labour intensive road construction project in Africa was started in Kenya in 1974. Many long-term national construction and maintenance programmes have since been established. It is estimated that 2 000 000 person-years of employment have been created in Botswana, Kenya, Lesotho and Malawi.

The experience gained in the mentioned programmes were first applied to road construction in South Africa in 1983. The principles were soon applied to all aspects of the provision of municipal infrastructure. Methods and procedures were adopted and guidelines drafted by, amongst others, the RKDP, DOT and DBSA.

The National Economic Forum (NEF) <sup>[1]</sup> in it's Initial Overview Report states that an estimated 40% of the population in South Africa lives in poverty. Van der Velde <sup>[2]</sup> states that 35% of the CMA's labour force could be unemployed by the turn of the century. Furthermore South Africa has an extremely low productivity caused mainly by:

- Labour turnover
- Low level motivation
- Lack of skills
- Inadequate training

The civil engineering construction industry already employs a huge labour force.

The implementation of LIC methods can, according to research and experience from practice, provide more jobs and training opportunities. While this will not address the total unemployment problem, it should have a marked positive effect on the creation of job opportunities as well as encouraging other industries to follow.

Against this background the South African Road Federation, Association of Civil Engineers, Federation of Civil Engineering Contractors, Institute of Civil Engineers and Institute of Municipal Engineers established the National Committee for LIC (NCLIC). The Framework Agreement was compiled in liaison with organised labour and signed by NCLIC and the Congress of South African Trade Unions (COSATU) on 22 June 1993. NCLIC, COSATU and the South African National Civic Organisation (SANCO) have since merged into the National Co-ordinating Committee (NCC). The Framework Agreement addresses guidelines on contract documentation, selection for employment, task based payment, training and conditions of employment. An Accreditation Board for Labour Intensive Construction (ABLIC) was constituted to evaluate projects in terms of the guidelines as contained in the Framework Agreement. ABLIC accreditation, amongst others, allows applicants to deviate from the minimum wage as stipulated by the Department of Manpower and implement the task-based payment system which is one of the fundamental aspects of LIC.

A number of township development projects based on the principles of the Framework Agreement have been initiated in the CMA and could be investigated and monitored to evaluate the use of LIC methods in the Cape Metropolitan area.

## **1.2 PURPOSES OF THE STUDY**

The aim of this study is to investigate LIC in South Africa and particularly as applied in township development in the Cape Metropolitan Area (CMA) in order



to compare it with conventional methods in an attempt to examine it's consequences and benefits and determine its viability as an alternative construction method.

Most clients are embarking on LIC because it seems to be the appropriate construction method in townships with high levels of unemployment and need for training. Given certain resources (labour, machines, funds) we should, however, endeavour to meet the objectives in the best way. The objectives are generally defined as follow:

- For Conventional Construction - The provision of civil engineering services to a prescribed quality standard, in a specific time period at the lowest possible cost.
- For Labour Intensive Construction - As before but adding that on the job training be provided and as many as possible job opportunities be created.

In determining the best way to achieve the objectives the following concepts need to be considered:

- efficiency - how well are we doing things?
- efficacy - how well are things put together?
- effectiveness - are we doing the right things?

In order to compare the two construction methods, a common objective will need to be defined, or a "value" will have to be coupled to the additional requirements when LIC is employed.

The following study objectives should be met in order to achieve the aforementioned:

- i) To identify and determine the long and short term economic implications when LIC is employed.

- ii) To determine how the timing of projects are influenced when LIC is used.
- iii) To determine whether adequate quality is maintained when LIC is employed.
- iv) To attempt to identify the social effects of LIC within communities involved in or effected by the project.
- v) To determine whether current contractual arrangements adequately facilitate the use of LIC.
- vi) To determine whether communication between all involved parties has developed to the extent that all the objectives of LIC can be realised.
- vii) To compare the findings of objectives i) to iii) with the industry's norms for conventional construction.
- viii) To identify problem areas in respect of LIC in the CMA and make recommendations.
- ix) To evaluate the viability of LIC as an alternative construction method in the CMA.

The current status of LIC projects will be investigated and evaluated, problems will be identified, and the study aims at making relevant recommendations.

### **1.3 , SCOPE OF THE THESIS**

The study focuses primarily on LIC of civil engineering services and in particular Township Development. Labour intensive road construction is, however, also covered in the information review, because LIC was first introduced in this field

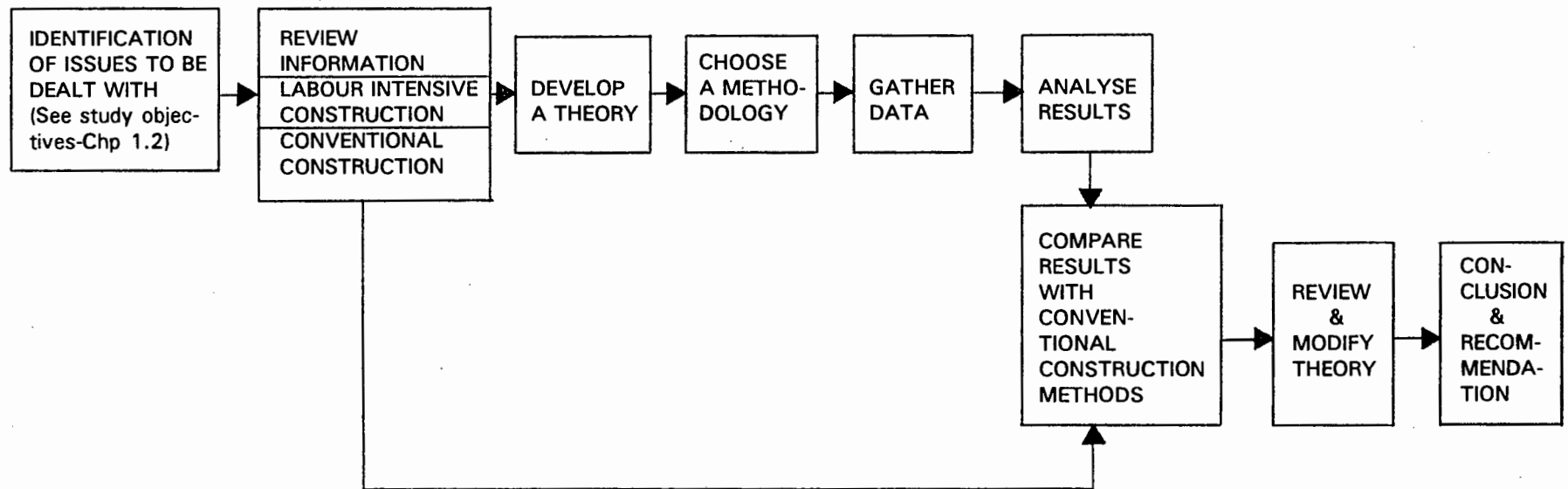
of civil engineering construction and because road construction is part of township development. Case studies will only cover township development projects to ensure that projects in a similar environment and covering the same type of construction are evaluated.

While experiences covering the whole of Africa are drawn on for background information, cases in the CMA are studied. The CMA, particularly the Cape Flats, where most township development is concentrated, has flat gradients and excavations are usually carried out in sand with calcrete layers. Clay is also present in areas around the Cape Flats. The study is also limited to this area to ensure that socio-economic conditions do not vary to a too large extent.

Projects executed with LIC methods are analysed, evaluated and compared to obtain valid information which will facilitate comparison with conventional construction methods. Statistics and information relating to conventional construction methods are readily available.

#### **1.4 PLAN OF DEVELOPMENT OF THE THESIS**

In order to holistically assess the viability of LIC all the study objectives, covering both "hard" and "soft" issues, are considered during the information review and in the investigation into specific cases. Issues which prove to present no problems in the transfer process from conventional to LIC, or where problems are adequately being addressed by the industry, will not be analysed in detail. An attempt will be made to address the problems which remain as obstacles to the viability of LIC. The planned thesis procedure is illustrated in **FIGURE 1.1**.



**FIGURE 1.1 PLAN OF DEVELOPMENT OF THE THESIS**

## **2. INFORMATION REVIEW**

Previous literature and other relevant information were studied in an attempt to:

- i) clearly understand the theory and all the principles relating to LIC.
- ii) determine the progress which has been made to date with the implementation of LIC.
- iii) establish whether LIC is a viable alternative to conventional township development methods in the Cape Metropolitan Area.

Many seminars in recent years focused on LIC methods. This resulted in many papers dealing with, amongst others, the background, theory, implementation and case studies relating to LIC methods in road construction and later, other civil engineering works. Many of the papers draw strongly on publications by Professor R McCutcheon and the Development Bank of Southern Africa as well as publications on work done in other parts of Africa. Very little has, however, been documented on LIC methods employed in the CMA.

### **2.1 THE LABOUR INTENSIVE CONSTRUCTION METHOD**

#### **2.1.1 Labour Based versus Labour Intensive**

Croswell<sup>[3]</sup> argues in 1988 that the two terms are in many ways interchangeable and are certainly not mutually exclusive. He defines LIC as the enhanced use of labour to carry out tasks or operations. Labour Based Construction is in turn defined by him as the process of conception, design, documentation, contracting, control and implementation bearing in mind the factor of production, namely

human labour.

It is clear, however, from recent literature that the two terms are nowadays both used for the process which Croswell termed Labour Based Construction, while it is clear that the term Labour Intensive Construction is favoured. Power <sup>[4]</sup> sums it up as follow:

"Without attempting to re-invent the wheel, I would suggest that we all agree with Professor Rob McCutcheon and the International Labour Organisation that Labour Intensive and Labour Based have the same meaning."

This view is supported by the Development Bank of Southern Africa (DBSA) <sup>[5]</sup> with the statement that "The essential difference is not between labour-intensive and labour-based, but between both of these terms and labour extensive where the emphasis is upon the numbers employed and little concern is shown for either the product or productivity."

### **2.1.2 Definition**

Labour Intensive Construction has been defined in many ways in past years but the members of NCLIC adopted the following:

THE ECONOMICALLY EFFICIENT EMPLOYMENT OF AS GREAT A PROPORTION OF LABOUR AS IS TECHNICALLY FEASIBLE, TO PRODUCE AS HIGH A STANDARD OF CONSTRUCTION AS DEMANDED BY THE SPECIFICATIONS AND ALLOWED BY THE FUNDING AVAILABLE.

The DBSA and McCutcheon <sup>[6]</sup> defines LIC in similar words. Most authors are in agreement that labour intensive methods can be viewed as the effective substitution of labour for equipment in construction. This should be done in such a fashion that there is neither an increase in economic cost nor a decrease in

quality.

The DBSA also argues that LIC is a substitution of local for imported energy. There are two main objectives; a significant increase in the use of labour per unit of expenditure, and in the South African context, the development of small contractors. The LIC process is considered to imply the conception, design, documentation and implementation of a project, orientated towards using manual labour to a maximum and promoting the use of local entrepreneurs.

According to COSATU <sup>[7]</sup> the Framework Agreement, signed on 22 June 1993 by COSATU and the members of the NCLIC aims to:

- use labour wherever possible, instead of machines, for public works construction projects - bearing in mind economic factors.  
and
- create jobs.

Their employment policy includes not only making maximum use of available labour and skills in communities, but also the development of human resource through training.

There is general agreement by writers that, as stated by Vance <sup>[8]</sup>, LIC is NOT:

- Only concerned with job creation
- Emergency relief work.
- The employment of a lot of labour, without any concern for time, cost and quality of construction.

The participation of communities in all aspects of LIC has in recent years become an important part of the process.

### 2.1.3 Theoretical Basis

McCutcheon <sup>[6]</sup> states that labour-intensive construction has a sound theoretical basis. This grew out of the recognition that the factors of production were different in developing countries from those in the industrialised world and it was also appreciated that the civil engineering industry offered huge employment potential. Theoretical analysis indicates why LIC might be technically feasible and economically efficient.

The theoretical foundation of LIC is well documented by Allal and Edmonds <sup>[9]</sup>, Edmonds and How <sup>[10]</sup>, Coukis et al <sup>[11]</sup> and de Veen <sup>[12]</sup> and a concise summary is offered in McCutcheon <sup>[6]</sup>. Some of the principle results of the extensive research and development which has taken place since 1971 are summarised by the DBSA <sup>[13]</sup> as follow:

- Labour-intensive methods are technically feasible for a wide range of construction activities. In road construction, for example, the World Bank found that it was technically feasible to substitute labour for equipment in all items making up 80 to 90% of total road construction project costs. Relaxation of standards to a lower quality, permitted labour substitution for an additional 5 to 6 per cent of costs.
- Labour-intensive methods of construction can generally produce the same quality of product as equipment-intensive methods.
- With superior tools, high incentives and good management, labour productivity can be improved to the point where labour-intensive methods can be fully competitive with equipment-intensive methods at certain break-even wages. The World Bank concluded that "Wherever the basic wage actually paid is less than R27 to R45 per day in 1993 prices, and labour is available in adequate quantities, the alternative of using labour-intensive techniques should be seriously considered."



- The smaller the operation and the more remote its location the greater the advantage of labour over equipment.

Additional to the above, which is reasoned on techno-economic grounds, are socio-economic benefits which can be derived from LIC namely the creation of employment for large numbers of unskilled & semi-skilled people and the imparting of skills.

McCutcheon <sup>[6]</sup> investigates the feasibility of the reverse substitution of labour for equipment and draws heavily on the work done by Deepak <sup>[14]</sup>. Two scenarios are evaluated: one where the substitution of equipment for labour had been essential, the other where it had not been essential or forced. It is concluded that the reverse substitution would only be feasible in the latter case and that it would be more suited to "product centred" industries. There seems therefore to be a theoretical basis for the technical feasibility of the reverse substitution of labour for equipment in civil construction in general.

## **2.2 PROGRESS TO DATE**

Judging by the number of seminars focusing exclusively on LIC which have been conducted in recent years, and numerous studies which have been undertaken by the Department of Transport (DOT), NEF, DBSA and others, it seems as if Labour Intensive Construction has, over a wide front, either been implemented or at least accepted as an alternative method of civil engineering construction. In fact many of the papers submitted cover case studies of LIC works, in progress or completed.

It can perhaps be argued that LIC was implemented in South Africa with limited information and without a decision-making framework, supporting documentation or skills in place. The need for employment created tremendous pressure for the

early implementation of LIC. Implementation thus followed the lines described by DOT <sup>[15]</sup> in May 1992:

"The fact that there are a very large number of unemployed people in South Africa, and that the number is growing all the time cannot be denied. It would be ideal to set up a number of carefully selected labour-based road projects in different environments, monitor these carefully, and then draw up a well considered strategy for selection, design, award, execution and financing. Time however does not permit an in-depth investigation and decision making before the full scale implementation of labour-based construction.

"The answer is to initiate a policy of labour-based construction on as wide a field as possible and based on the information presently available. Monitoring would be commenced on these projects and the policy and methods refined on an ongoing basis".

### **2.2.1 Project Implementation**

DOT <sup>[16]</sup> reviews seven LIC projects completed by May 1992 and put similar questions to the Consultant or Client on each project when enquiries were made. Feedback was generally consistent across the seven cases and can be summarised as follow:

- General Conditions of Contract and SABS 1200 Standard Specifications were used but modified by Special Conditions of Contract and Particular Specifications respectively. No problems with this aspect of the projects were reported.
- Work produced was of good standard and quality.
- Work was reported to have been "economically" executed taking into account certain circumstances (*labour problems, insufficient control, etc.*) and the fact that as much as 30% of the project value is "*ploughed*" into

the community. This was unfortunately not backed up with figures.

- People were effectively trained to operate as independent sub-contractors, drain layers, supervisors, clerks, and storemen.
- Problems encountered include community relations, motivation of labour, and control.

NEF <sup>[17]</sup> reports that conclusions reached by the Independent Development Trust (IDT) in an assessment of their Capital Subsidy Scheme are that:

- There is no clear evidence that labour-based construction is more or less expensive, but positive benefits, such as the creation of jobs, training and better security are derived from labour based approaches;
- Success of labour based construction depends on management, design and tendering;
- If a labour-based approach is conceptualised and set up as an economic development exercise, the results can be improved.

It is surprising that the IDT could not financially compare LIC with conventional construction. Their identification of management, design and tendering as determinants for success also conflicts to a certain extent with other findings. Feedback is reported in many papers covering case studies of projects undertaken all over South Africa. Unfortunately projects were not undertaken within a uniform framework i.e. in some cases payment is task-based and in others not; different project management approaches were used and socio-economical circumstances differ. The lack of a co-ordinated monitoring system is identified by DOT<sup>[18]</sup>:

"In the context of the need for and justification of labour-based construction, monitoring is required to provide basic information in all aspects of labour-based construction from community attitudes to unit costs of construction" and  
"Information obtained through normal management structures on a project is

likely to be distorted, often unintentionally, to reflect the viewpoint of that management."

Literature specifically covering the implementation of LIC projects in the Western Cape was scarce. Lambrechts <sup>[19]</sup> presents a table (see **TABLE 2.1**) which summarises development statistics for Western Cape Labour Intensive projects.

	NUMBER OF SITES	PERSON-TASKS	COMMUNITY INCOME	TRAINING: AMOUNT VOTED
Crossroads Pilot	163	6 500	R162 500	R 50 000
Driftsands	500	25 500	R637 500	R100 000
Crossroads Phase 4	423	(15 500 est)	R387 500	R100 000
Bloekombos Phase 1	1003	55 343 tendered	R1 383 575	R100 000
Bloekombos Phase 2	821	36 700 tendered	R917 500	R100 000
Waterkloof Phase 1	1048	10 000	R250 000	R 20 000
Waterkloof Phase 2	772	8 800	R220 000	R 12 000

**TABLE 2.1 DEVELOPMENT STATISTICS**

### **2.2.2 The economic implications of Labour Intensive Construction**

The economic viability of LIC will, to a large extent, determine its future and this aspect of LIC therefore warrants special attention. The newly established National Housing Board in its Implementation Manual stipulate that funds for

housing development (provision of engineering services and a structure) will be allocated in the form of capital subsidies to persons in the low income categories. The subsidies are based on income and are fixed. People in the lowest income bracket, below R1 500-00 per month, will receive a once-off subsidy amounting to R12 500-00. Any increase in construction costs thus leaves the recipient of a subsidy with less funds to be spent on what is termed by the National Housing Board as a "top structure".

The challenge of providing affordable housing is emphasized by Touzel et al <sup>[20]</sup>. It is argued that 60% of black households earn below R1 000 per month and that these households will not be able to afford any form of housing apart from the state subsidy. The R12 500 subsidy which applies to this income bracket is thus the only fund available for the provision of both serviced land and dwelling. In the CMA where the high water table and soil conditions demands services of a high standard in order to contain maintenance costs, it is important to ensure that funds spent on development, benefit the end user or recipient of the product most effectively.

Still <sup>[21]</sup> reports in 1992 that the Labour Intensive replacement of Soweto's antiquated asbestos-cement water reticulation is providing work for 900 labourers and has been underway for three years at the time of writing with an estimated saving of 18% over the conventional method. It is stated that this saving is remarkable and while not explicitly mentioned, the work (excavation in areas where access is difficult) probably lends itself to manual work. The paper suggests that LIC should be chosen where it is cheaper or up to 10 - 20% more expensive than conventional methods. This "premium" is discounted against the claimed benefits of LIC, namely unemployment relief, retention of capital within a community, stimulation of entrepreneurship and community ownership of works.

Most other project reports mention that work was "economically done" or "economically done in circumstances", but these statements are not backed up

with quantified facts. Boothway <sup>[22]</sup> states that "labour-intensive roads cost generally 10-15% more than machine built roads," while RKDP <sup>[23]</sup> in its guidelines states that the Natal Provincial Administration has accepted a maximum premium of 10% to be used in approving labour intensive contracts. The premium is determined by using two separate schedules of quantities, one for "machine option" and the other for "labour option" or by splitting quantities in one schedule between the options.

The minutes of a meeting at the "Bloekombos" LIC site on 27 January 1994 between consultants to the National Housing Forum and parties involved in the project included the statement: "It is accepted that the contract using these labour intensive methods will be of the order of 10% higher than the conventional contract". This increase in cost is based on a payment of R25 per person per task (a task being the amount of work that is expected from a person in a working day).

The uncertainty surrounding actual cost comparisons and values of social benefits is underlined in Engineering News's <sup>[24]</sup> interview with the SAFCEC executive director, Dr W Vance. The definition quoted in the article reads that "Labour Intensive Construction is the reasonably economically efficient employment of ....." . The article also states that "The social benefits of a project may be deemed to offset any increase in cost that may result".

Unfortunately little attention seems to have been given to the assessment of the financial feasibility of LIC. In order to effectively evaluate the cost effectiveness of alternative construction methods, it is also necessary to quantify the socio-economic benefits of LIC.

### **2.2.3 Conclusion**

Some of the crucial questions about LIC, namely its cost effectiveness, timing, quality and social benefits, remain to a large extent unanswered. The guidelines produced by the DBSA<sup>[5]</sup>, DOT<sup>[15]</sup>, RKDP<sup>[23]</sup> and others, however, enable any competent developer to embark on LIC. The "Interim guidelines for labour-based construction projects" produced by DBSA<sup>[5]</sup> is perhaps the most comprehensive document covering all phases of development from pre-feasibility report to maintenance. When embarking on liaison with the community the document, "The Framework Agreement for public works projects using labour intensive construction systems - A Guide for Workers and Communities" by COSATU<sup>[7]</sup> will be of great value.

## **2.3 THE VIABILITY OF LABOUR INTENSIVE CONSTRUCTION IN THE CMA**

While very little has been reported on LIC in the CMA, the National experience suggests that little problems should be encountered with quality, time, contractual arrangements and that viability will therefore depend largely on economic viability, communication and control as well as other "softer issues".

The information review offers a wealth of applicable information on all aspects of LIC. It, however, fails to adequately compare LIC directly with conventional methods in practice, especially in the CMA with its unique soil conditions and socio-economic and political environment.

## **2.4 CONVENTIONAL CONSTRUCTION METHODS**

In order to comment on the viability of LIC it needs to be evaluated against a norm. Conventional construction is well documented and a review of 4827 sites of 160 m<sup>2</sup> each, developed in the Cape Metropolitan Area revealed an average development cost of R9 806 per site when escalated to January 1994 at an escalation rate of 9%\* per year. Projects reviewed included KH5/1989, KH2A/1990 and KH2B/1990 in Khayelitsha as well as the servicing of 507 sites in Wallacedene near Kraaifontein.

The above include both direct and indirect costs, but excludes bulk earthworks and the provision of bulk services. These typical conventional construction development costs are confirmed by various other civil engineering consultants actively involved with LIC.

\* Consulting engineers interviewed quoted escalation for township development in the order of 9%.



### 3. RESEARCH METHOD AND PROCEDURE

The aim of this thesis is to establish whether LIC is a viable alternative for township development in the CMA. Considering the objectives of the study listed in 1.2, it is clear that some question about LIC remain unanswered by the literature review. The reasons could be:

- The viability of LIC has not been questioned to a large extent as decision makers were "forced into" this option by the political environment and socio-economic conditions.
- The technical aspects of LIC (contractual procedure, timing and quality) have generally been adequately addressed because engineers were at the forefront of inducing the change to LIC. A "holistic" approach was, however, not followed and the non-technical issues were only addressed as they presented problems during implementation.
- LIC has only been employed in the CMA in recent years and, in most cases, projects are not yet complete.

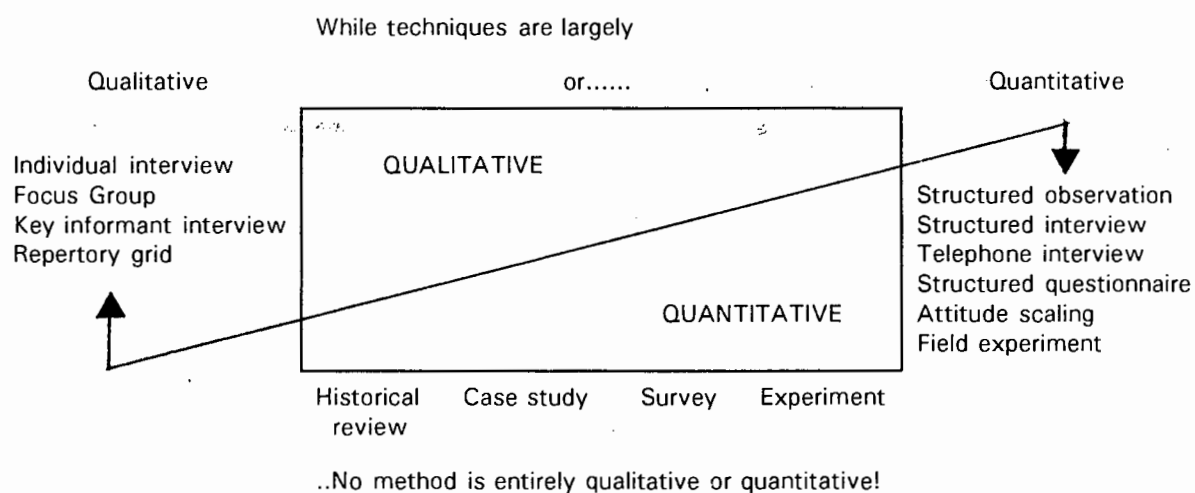
In order to meet the aim (or goal) of the thesis, specific information on LIC and conventional township development projects in the CMA is required. Data relating to conventional construction methods in the CMA is readily available from, amongst others, the firm BKS Inc who acted as project managers on many of these projects in the CMA.

Very little has, however, been documented on LIC township development projects in the CMA and a suitable **method** must be employed to collect data in an orderly approach so that valid information can be obtained from the data.

Data could be sourced from the cases mentioned in 2.2.1.

### 3.1 CHOICE OF RESEARCH METHOD

Jankowicz<sup>[25]</sup> summarises the qualitative and quantitative nature of the four main research methods with techniques to obtain data as presented in **FIGURE 3.1**.



**FIGURE 3.1 METHODS AND TECHNIQUES, QUALITATIVE AND QUANTITATIVE.**

YIN<sup>[26]</sup> states that three conditions distinguish between the different methods or strategies, namely:

- the type of research question posed
- the extent of control over behavioral events
- degree of focus on contemporary events.

The **case study** method has a distinct advantage when "how" and "why" questions are being asked about a contemporary set of events, over which the investigator has little or no control. Considering these conditions, the case study method fits the requirements ideally. The six cases are in process or have been

recently completed and, as such, reflect "current" experiences. The investigator has no control over events and questions of the nature; "**Why** were problems experienced?" or "**How** was the community involved?" are most suited for an enquiry of the mentioned cases.

A further advantage of the case study method is the fact that multiple sources of evidence are used. Data relating to the LIC case studies can be sourced amongst others from documentation, interviews and direct observation.

The survey method would also be applicable; but this method requires questions to be directed at relatively large groups of people. Only six cases are available in the CMA, one of which was a pilot project and might have to be rejected as a case. It will thus not be possible to gather a representative **sample** of cases (as required for the survey method) but a systematic comparison or **replication** of cases will be done to verify findings.

### **3.2 THE CASE STUDY METHOD**

YIN (1984) provides the following "technical" definition:

A case study is an empirical inquiry that:

- investigates a contemporary phenomenon within its real-life context; when
- the boundaries between phenomenon and context are not clearly evident; and in which
- multiple sources of evidence are used.

The distinctive characteristics of the case study strategy is comprehensively covered by YIN (1984) and summarised as a "holistic" illustration in **APPENDIX A.**

### 3.2.1 Case study Design

The **research design** (logic that links the data to be collected to the initial questions of a study) is an essential "blueprint" to guide an investigator through the case study method and ensure that the quality of a design is maximised.

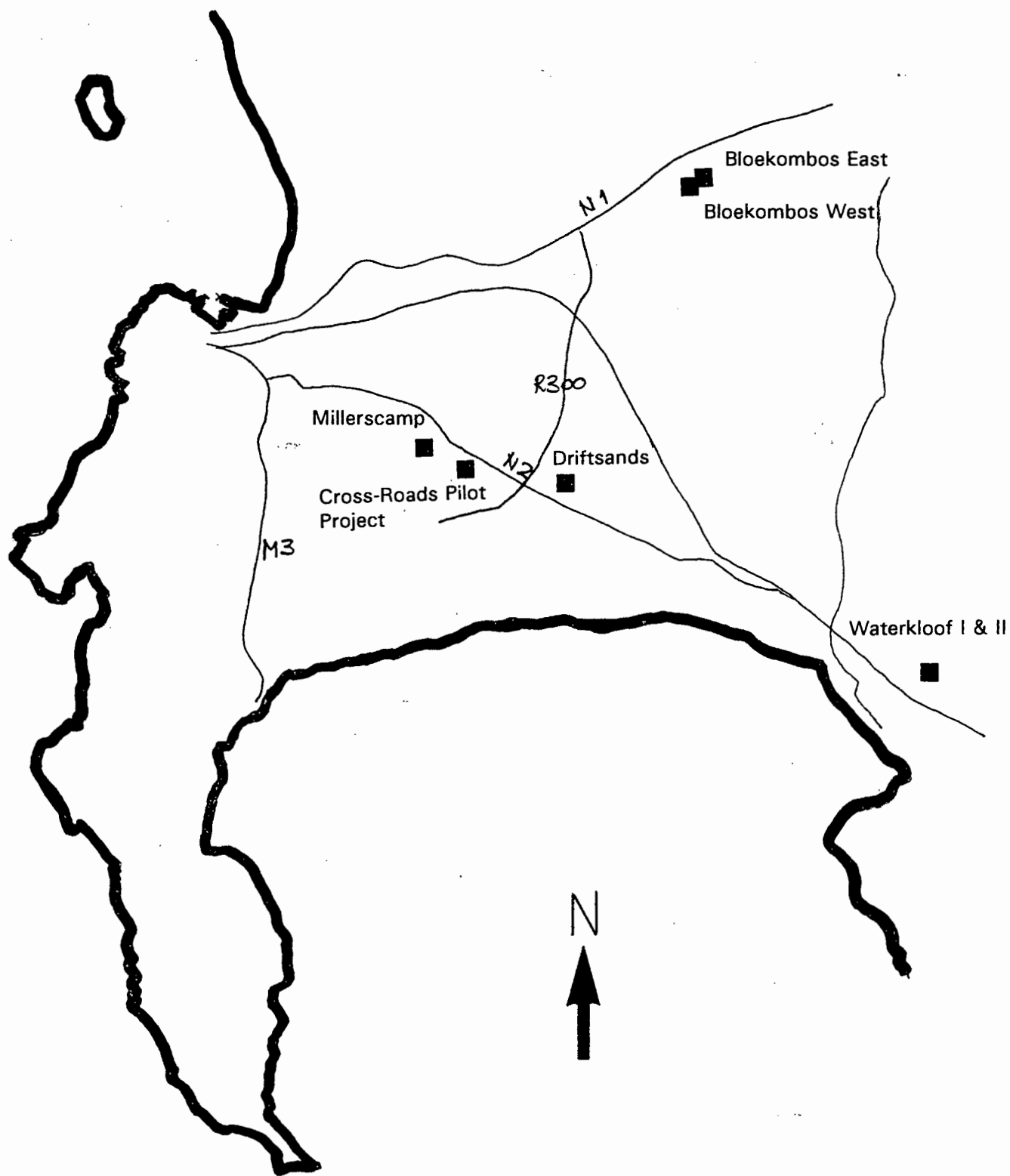
The study's aim and objectives listed in 1.2 are used as a basis for the study's questions as presented in **APPENDIX B, page B2**.

The unit of analysis or "case" is defined as a LIC project within the scope of this study i.e. within the boundaries of the CMA and where township services are provided. Potential cases include:

- Bloekombos West
- Bloekombos East
- Millerscamp
- Driftsands
- Waterkloof
- Crossroads pilot project

The locality of the above cases (LIC projects) are shown in **FIGURE 3.2**.

In order to address all the objectives of the study, certain data relating to conventional construction methods used in similar circumstances will also need to be gathered. This information has however been well documented over many years. It is readily available and can be gathered directly from consulting engineers and not by investigating specific cases.



**FIGURE 3.2 LOCALITY OF LABOUR INTENSIVE CONSTRUCTION PROJECTS**

Case studies can be designed as single-case or multiple-case with unitary (holistic) or multiple (embedded) units of analysis (see **APPENDIX A**). Six potential cases will be studied and a *multiple-case* design will thus be appropriate. As the study will focus on the "global" nature of LIC it could be termed *holistic*. The research method used will therefore be for a *holistic multiple-case* study.

The multiple-case design allows data to be verified by *replication* and not sampling logic. Cases can produce similar results (literal replication) or contrary results but for predictable reasons (theoretical replication). The study will cover both LIC and its context, yielding a large number of potential relevant variables. Should sampling logic be followed this would lead to an impossibly large number of cases.

The *case study protocol* contains the procedures and rules to be followed with data collection. It covers, amongst others, field procedures and the protocol questions. These *protocol questions* (posed at the investigator, not a respondent) are accompanied by a list of probable sources of evidence and strategies. In **APPENDIX B** the case study questions are followed by a list of protocol questions with possible sources of data and sample strategies to be used for investigating each of the six identified cases.

Evidence was collected from six sources of data as presented in **APPENDIX A**. This study will mostly rely on data gathered through interviews, perusal of documents and records. A chain of evidence will be maintained i.e. questions asked, data collected and conclusions drawn will be linked.

### 3.2.2 Designing-in Quality

Four relevant tests are established to judge the quality of a study (see **APPENDIX A**). The tests and the tactics which will be followed to deal with these tests are summarised in **TABLE 3.1**.

TEST	TACTIC
<i>Construct validity</i> -	Use multiple sources of evidence. (Interviews are complemented with documentation and records).
<i>Internal validity</i> -	Pattern-matching and explanation-building are attempted in the analysis phase.
<i>External validity</i> -	Use of replication logic across cases. (This is addressed in the analysis phase).
<i>Reliability</i> -	Use case study protocol. (During data collection).

**TABLE 3.1            CASE STUDY TACTICS FOR FOUR DESIGN TESTS**

### **3.2.3 Analysing and Composing**

The general strategy followed in the analysis phase is that of *relying on the issues to be dealt with* as identified in the stated objectives and the study's questions. Two analytic techniques are used:

<i>Pattern-matching</i> -	Comparing empirically based patterns with one or alternative predicted patterns.
<i>Explanation-building</i> -	To "explain" or stipulate a set of casual links about a phenomenon.

## **3.3 PROCEDURE**

The procedure followed in this study, as illustrated in **FIGURE 1.1**, can be modified as illustrated in **FIGURE 3.3**. A pilot case study was not conducted, but the case study design was reviewed after each case study was investigated.

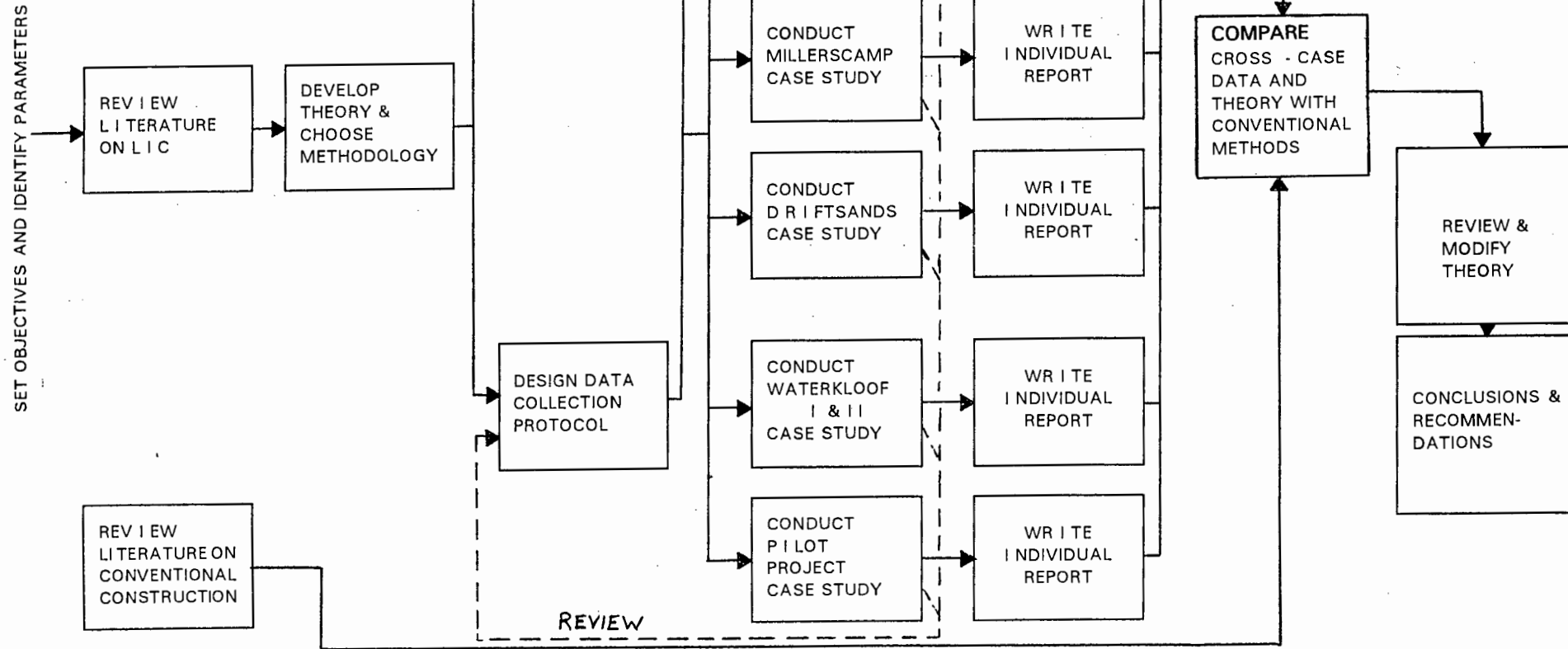


FIGURE 3.3 STUDY PROCEDURE INCORPORATING MULTIPLE CASE STUDY METHOD



## 4 RESULTS

The individual single cases are summarised in **APPENDIX C**. The description of the cases follows the stated objectives and case study questions, but stops short of comparing data across cases.

Prior to actual analysis, it is useful to order information into different arrays and placing evidence into a matrix of categories. **TABLES 4.1 to 4.2** covers the general data relevant to each case as well as specific data related to the study's objectives and questions.

**TABLE 4.1** and **4.2** contains general development statistics and data. The purpose in summarising this data is to ensure that the conditions pertaining to each case falls within an envelope with acceptable boundaries. Scrutinising this data reveals that the parameters of the six cases do not vary much other than specific exceptions. The development cost for sites in Driftsands will be higher due to the 180 m<sup>2</sup> size. When costs are compared an adjustment will be necessary. The water table was encountered near to ground level in all cases except Waterkloof which is located at the outskirts of the CMA. In this case hard material was encountered and this is reflected in the fact that all excavation was done mechanically. Only the main data is summarised in the tables but secondary data and evidence are captured in the single-case reports. **FIGURES 4.1 and 4.2** illustrate LIC work in progress.

	TOWN PLANNING		SOILS CONDITION	
	No of Sites	Ave. site size (m <sup>2</sup> )	Type	Water Table Depth
Bloekombos West	1024	160	sand & bands of clay	0,5-1,0m
Bloekombos East	821	160	sand	0,7-1m
Millerscamp	446	160	sand & refuse	0,5-1,0m
Driftsands	500	180	sand	+ 1m
Waterkloof I & II	1803	160	shale & clay	n/a
Cross-Roads Pilot Project	163	160	sand & bands of calcrete	0-2,0m

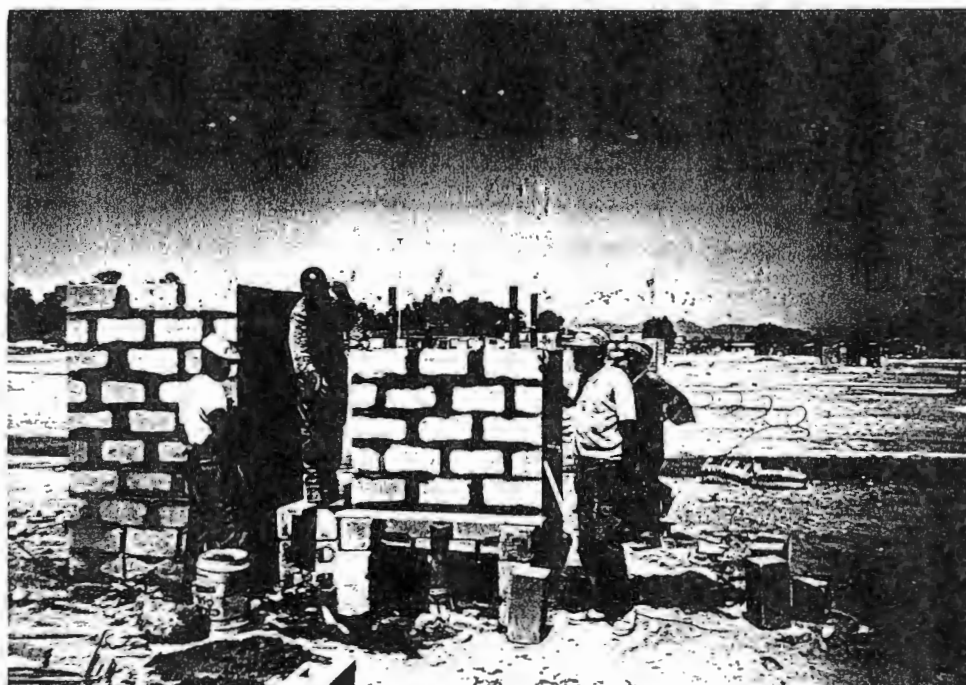
TABLE 4.1 GENERAL DEVELOPMENT STATISTICS

	ROADS		UNDERGROUND SERVICES		TOILETS		
	Aspects of road construction	Kerb manuf. & laying	Excavation	Backfill	Brick-making	Construction	Plumbing
Bloekombos West	✓	✓	✓	✓	✓	✓	✓
Bloekombos East	✓	✓	✓	✓	✓	✓	✓
Millerscamp	✓	✓	✓	✓	✓	✓	✓
Driftsands	✓	✓	✓	✓	✓	✓	✓
Waterkloof I & II		✓		✓	✓	✓	✓
Cross-Roads	✓	✓	✓	✓	✓	✓	✓

TABLE 4.2 WORKS EXECUTED BY LIC METHODS



**FIGURE 4.1 ASPECTS OF LABOUR INTENSIVE ROAD CONSTRUCTION**



**FIGURE 4.2 BLOCK-MAKING AND TOILET CONSTRUCTION**

In **TABLE 4.3** the total cost per site, for LIC, escalated to a base date of January 1994, varies from R 10 376 to R 11 510 with an average of R11 034. Waterkloof with its low percentage of cost allocated to local labour could be disregarded, bringing the average to R 11 004. A figure rounded off to R 11 000 should suffice. With Waterkloof once again discarded, the local labour portion of the costs varies from 10,1% to 12,1% with an average of 10,9%. It is interesting to note that tenders for Bloekombos West closed directly after it became known that the tender adjudication for Bloekombos East was to a large extent influenced by the number of person-tasks tendered. This is reflected in the higher percentage of cost spent on local labour at Bloekombos West and consequently the higher total cost. The figure of 12.1% should therefore be treated as an unrealistically high upper boundary.

	COST PER SITE	COMMENCEMENT DATE	COST PER SITE ESCALATED TO START DATE JAN '94 (9%/YR*)	PERSON-TASKS (NO)	TASK RATE (R)	% OF TOTAL COST SPENT ON LOCAL LABOUR
Bloekombos West	11270	JAN 1994	11270	55343	25-00	12,1
Bloekombos East	10223	NOV 1993	10376	36700	25-00	10,9
Millerscamp	10346	OCT 1992	11510	23700	20-00	11,1
LIC	11480	JUNE 1993	10923**	25500	25-00	10,1
Driftsands Conven	10557	JUNE 1993	10101**	N/A	N/A	N/A
Waterkloof I & II	10260	JAN 1993	11183	23200	25-00***	3,1
Cross-Roads Pilot Project	10123	MARCH 1993	10882	6860	25-00	10,4

\* 9% Escallation figure obtained from various consulting engineers.

\*\* Adjusted cost to allow for the larger sites (180m<sup>2</sup>). Cost of service is dependent on the width of the site. (Factor of  $10^{1/11}$  used)

\*\*\* 7067 person-tasks were executed at minimum wage.

**TABLE 4.3 DEVELOPMENT COSTS**

From the contents of **TABLE 4.4** it is clear that, although no pattern emerges, the brief and remuneration of consultants are problematic. In the cases where engineering consultants are involved in community liaison they generally feel that they are underpaid, while in one case where they are not involved they suggest that this arrangement is detrimental to the project. A strategy should be determined to address this problem.

	CURRENT ARRANGEMENT		SUGGESTION
	DESIGN & SUPERVISION IN ACCORDANCE WITH MODEL FORM 1	OTHER COMMITMENTS	SUGGESTIONS BY CONSULTANTS
Bloekombos West	✓	Engineering consultant handles community liaison on time-cost basis	Compensation for liaison purposes should be reviewed. Consultant should not be involved in industrial relations issues.
Bloekombos East	✓	Engineering consultant handles community liaison on time-cost basis	Design fees should be increased, but especially supervision fees ( <i>by as much as 50%</i> )
Millerscamp	✓	Engineering consultant handles community liaison on time-cost basis	no suggestion
Driftsands	✓	Project managers were appointed additional to the engineering consultant	no suggestion
Waterkloof I & II	✓	Community liaison were conducted by another firm	The engineering consultant is of the opinion that his direct involvement in liaison would have positive spin-offs
Cross-Roads Pilot Project	✓	Project managers were appointed additional to the engineering consultant	no suggestion

**TABLE 4.4 CONSULTANTS' BRIEF AND BASIS FOR REMUNERATION**

Construction periods were not altered for LIC, but delays were experienced. In most cases incidents of vandalism were minimal and political unrest was experienced only from external sources. **TABLE 4.5**, however, indicates that in four of the cases serious delays were caused by labour unrest which can be directly attributed to the use of LIC methods. Disputes arose around the task-based principle, and where local sub-contractors were employed, they often underpaid their labourers with resulting labour problems.

	TENDERED CONSTRUCTION PERIOD (MONTHS)	ACTUAL OR ESTIMATED PERIOD (MONTHS)	DELAYS (MONTHS)	COMMENTS
Bloekombos West	12	12½	16 (days to date)	Labour related
Bloekombos East	10	11	1	Delay caused by labour unrest
Millerscamp	9	12	2 1	"External" political unrest Labour related - sub-contractors underpaying labourers
Driftsands	10	13	2 6days) 15(days)	Community reluctance to relocate Labour related Weather related
Waterkloof I & II	13	16	2 1	Weather related delays Delay caused by labour unrest
Cross-Roads Pilot Project	N/A	N/A	NIL	Contract not completed

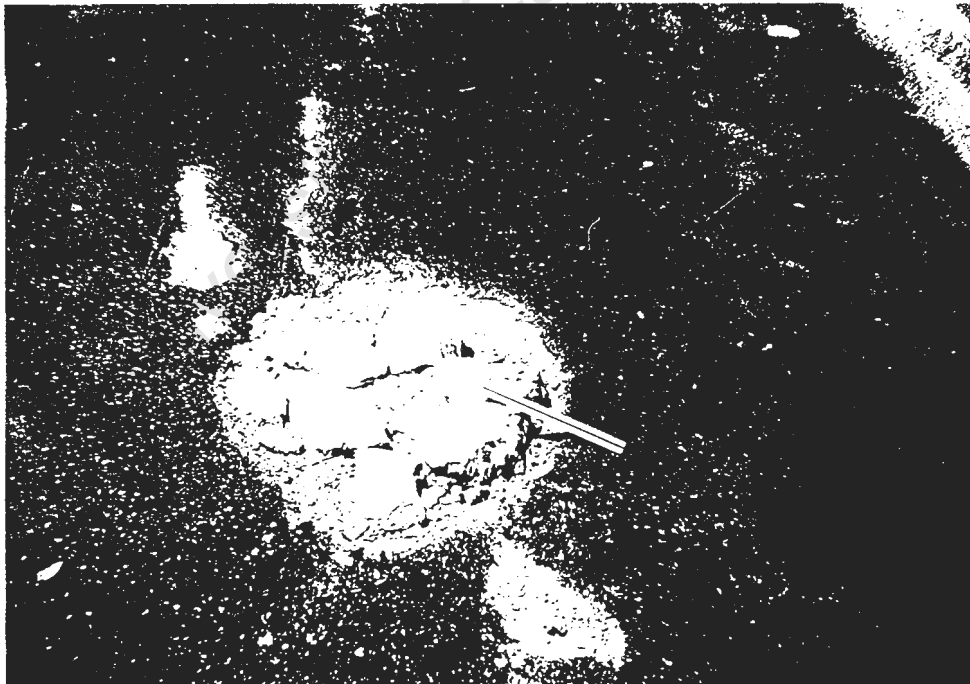
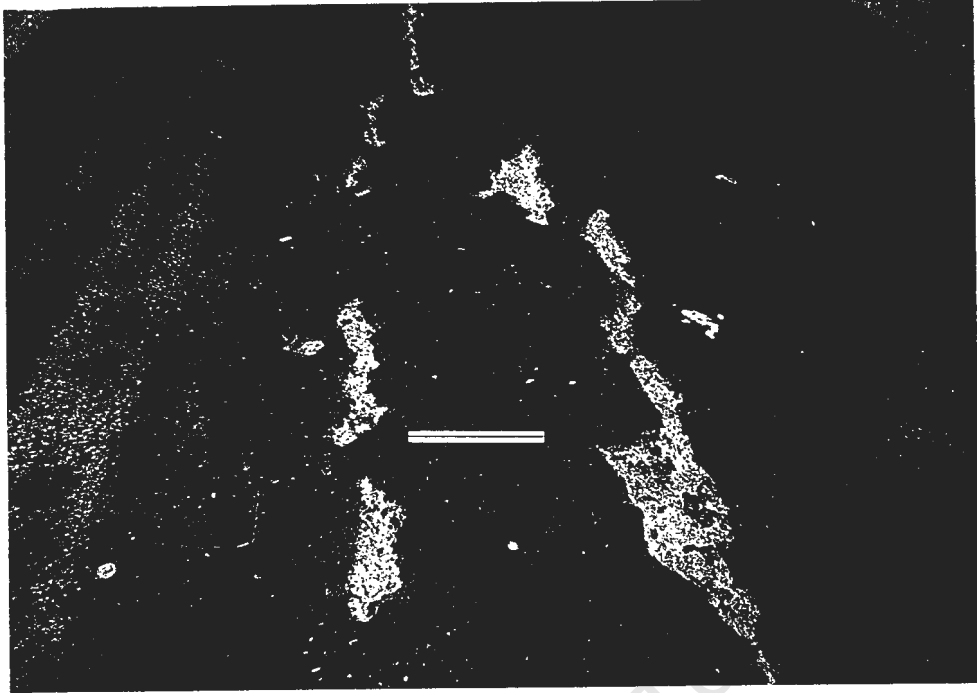
**TABLE 4.5 CONSTRUCTION PERIODS AND DELAYS**

In no case were quality standards lowered and the required standards were achieved with a single exception as illustrated in **TABLE 4.6**. In the case of Millerscamp not only the roadbed preparation but also the working of the road layers were done manually. This led to poorly graded patches in the layers, causing the road to fail in localised areas. The results are clearly illustrated in **FIGURE 4.3**.

	STANDARD SIMILAR TO CONVENTIONAL CONSTRUCTION SPECIFIED	STANDARD GENERALLY ACHIEVED	COMMENTS
Bloekombos West	✓	✓	
Bloekombos East	✓	✓	
Millerscamp	✓	✓ <i>(except for road construction)</i>	Patches of road failed due to poorly graded material in the road layers. The problem could be sourced to "overworking" when hand preparation was done
Driftsands	✓	✓	
Waterkloof I & II	✓	✓	
Cross-Roads Pilot Project	✓	✓	

**TABLE 4.6    QUALITY ACHIEVED WITH LABOUR INTENSIVE CONSTRUCTION**





**FIGURE 4.3 ROAD FAILURE DUE TO POORLY GRADED ROAD LAYERS**

**TABLE 4.7** lists the main benefits to the community, namely the number of people employed and trained, while **TABLE 4.8** indicates that standard technical documentation, adapted for LIC use, presented no problems. In two cases tenders were evaluated placing a high premium on the number of person-tasks tendered without coupling any quantitative value to it. This practice can lead to a false inflation of person-tasks.

	AVERAGE NO OF PEOPLE EMPLOYED	DURATION OF EMPLOYMENT (MONTHS)	AMOUNT ALLOWED IN CONTRACT FOR TRAINING
Bloekombos West	210	12	R100 000
Bloekombos East	166	10	R100 000
Millerscamp	90	12	?
Driftsands	90	13	R100 000
Waterkloof I & II	80	13	R 32 000
Cross-Roads Pilot Project	78	4	R 50 000

**TABLE 4.7 TRAINING AND EMPLOYMENT BENEFITS**

	STANDARD, ADAPTED DOC'S GCC & SABS 1200 USED	PROBLEMS EXPERIENCED	LOWEST TENDER ACCEPTED		REASONS (IF NO)
			YES	NO	
Bloekombos West	✓	NO		✓	High task rate tendered
Bloekombos East	✓	NO		✓	High task rate tendered
Millerscamp	✓	NO	✓		
Driftsands	✓	NO		✓	Other reasons than high task rate
Waterkloof I & II	✓	NO	✓		No of person tasks specified in tender
Cross-Roads Pilot Project	✓	NO		✓	Other reasons than high task rate

**TABLE      4.8    CONTRACTUAL ARRANGEMENT**

The capacity of the local community to fulfill their role in LIC projects successfully was in most cases cited as a problem leading to, amongst others, labour unrest and work stoppages. Whenever leadership was not well established and the local community not structured, communication was a problem. A change in leadership would imply that new leaders be briefed anew. Under such circumstances labour unrest and work stoppages were normal. **TABLE 4.9** summarises this aspect.

	LEGITIMACY OF COMMUNITY LEADERS		COMMENTS
	PROBLEMATIC	NOT PROBLEMATIC	
Bloekombos West	✓		Leadership changed during course of project
Bloekombos East	✓		Leadership changed during course of project
Millerscamp	✓		Leadership changed during course of project
Driftsands		✓	Leadership well established
Waterkloof I & II	✓		Leadership changed during course of project
Cross-Roads Pilot Project		✓	Leadership well established

**TABLE 4.9 STATUS OF COMMUNITY LEADERSHIP**

## 5 ANALYSIS

In chapter 4 the cross-case data was categorised and tabulated in accordance with the study's objectives and questions. In this analysis phase, this "ordered" data will be recombined and analysed using pattern-matching and explanation-building techniques.

### 5.1 SYNTHESIS OF THE THEORY OF LIC.

Drawing from the theory of LIC as given in chapter 2 as well as comments on numerous cases nationwide written up in papers presented at seminars, it can be suggested that there should be an effective substitution of equipment for labour under the following conditions:

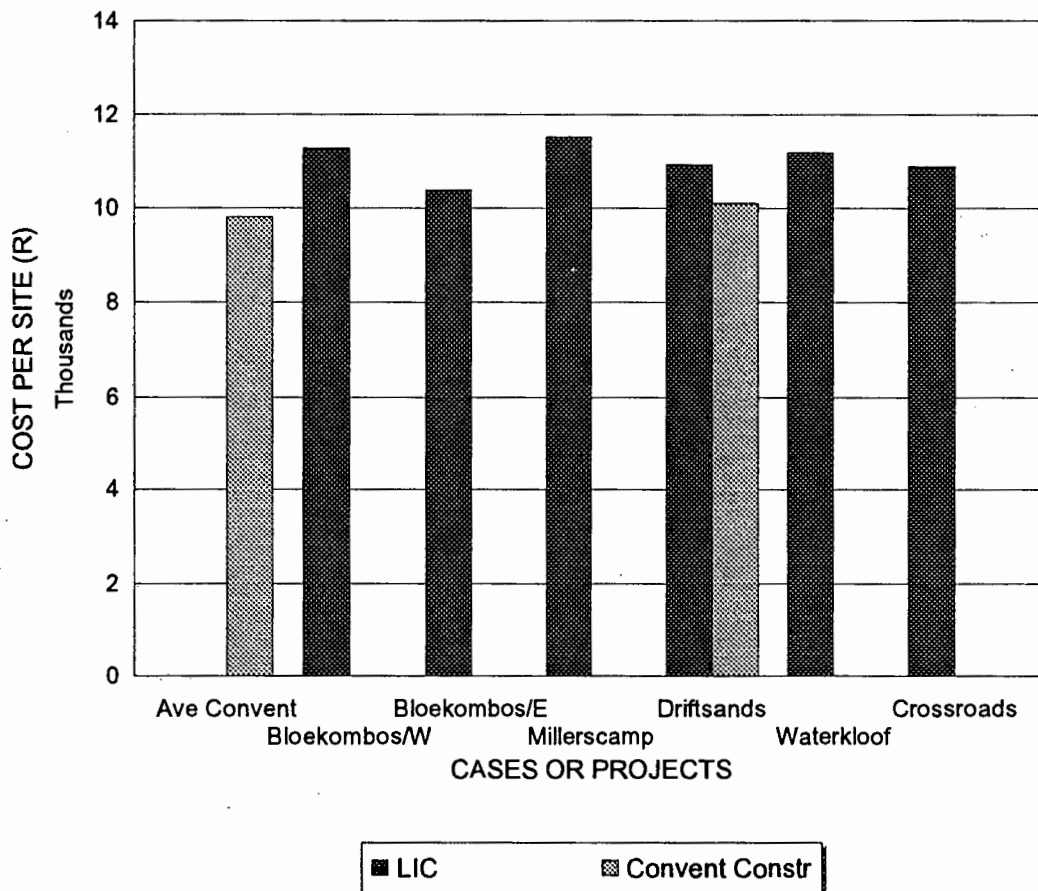
- i) The economic cost should not be increased. At 1993 break-even wages of R27 to R45 the two methods can be fully competitive. Some experts, however, are of the opinion that a LIC contract will cost around 10% more and that this additional cost can be discounted against the social benefits, implying that economic cost up to this boundary is acceptable.
- ii) There should be no decrease in quality.
- iii) There should be a concern for construction time.
- iv) People should be developed through training and the attainment of skills.
- v) Technical contractual procedures - specification, conditions of tender, agreements, tender evaluation procedure and site supervision and communication - should be in place.
- vi) Communities should be involved in all aspects of LIC.
- vii) The remoteness of the project should favour LIC methods i.e. the more remote the site, the more viable LIC should be.
- viii) LIC methods are technically feasible for a wide range of activities i.e. more than 80% by cost of items in road construction.

## 5.2 ASPECTS OF LABOUR INTENSIVE CONSTRUCTION

Although individual aspects of LIC will be dealt with, it will be shown that some of the "sub-systems" are interlinked and cannot be addressed in isolation.

### 5.2.1 Financial, economic and social analysis.

Financial data (January 1994 costs) relating to conventional and labour-intensive methods covered in this study is illustrated in **FIGURE 5.1**.



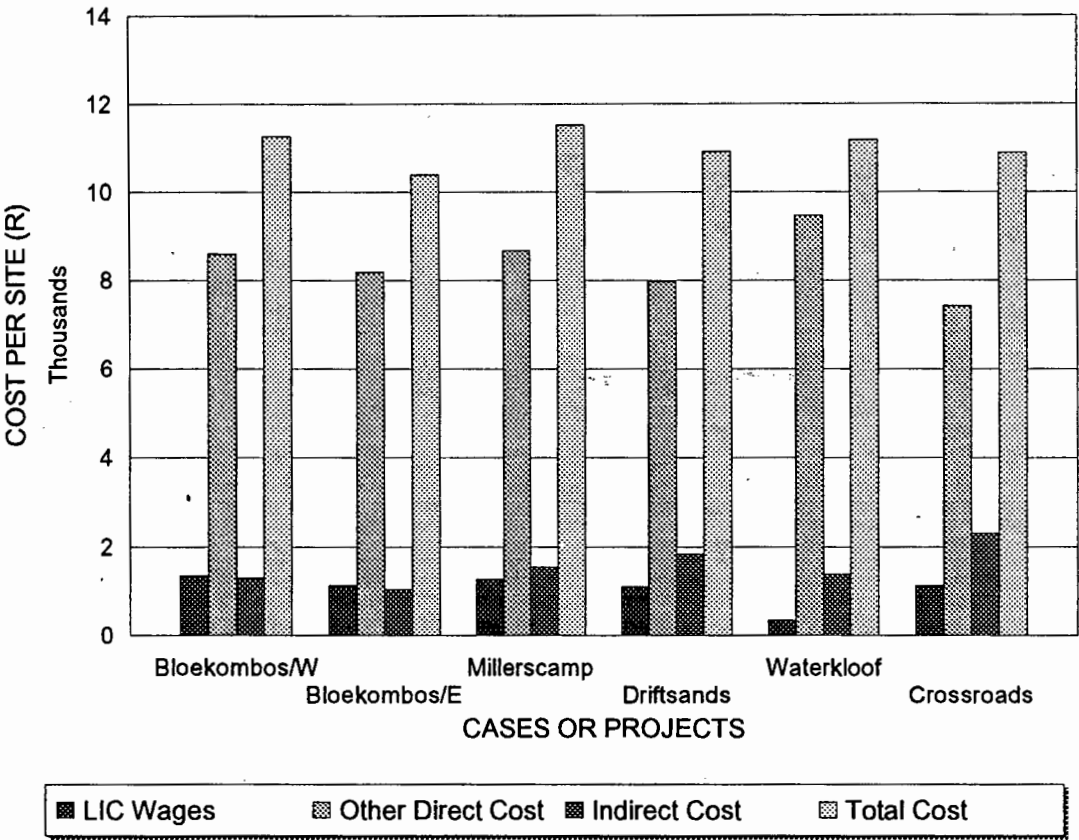
**FIGURE 5.1 COST COMPARISON - LABOUR INTENSIVE AND CONVENTIONAL**

In the Driftsands tender alternative prices for machine excavation and backfill were invited. The contractor further indicated that his billed items "Preliminary & General" and "Toilet construction" would be 5% and 10% lower respectively in the event of conventional methods being prescribed. Considering these cost adjustments and discarding the amount allocated to training, a cost of R 10 557 per site is derived once the effect on indirect cost is also calculated. Once this cost is adjusted to allow for the wider frontage of the Driftsands sites, the cost becomes R 10 101 per site (see **TABLE 4.3**). This represents an excellent basis for determining a comparable cost for a conventional contract.

Considering the average cost per site in respect of conventional construction amounting to R9 806, LIC cost per site for each case is respectively 14,9%; 5,8%; 17,4%; 12%; 14% and 11% (following the sequence in which the cases were described) higher than the cost per site for conventional construction. A comparison of the cost of LIC with that of conventional methods in the case of Driftsands (where conditions are similar for both alternatives) indicated that a "premium" of 8,7% was paid for using LIC. Due to the absence of a sample size, this data cannot be analysed with statistical methods, however, it is clear from a visual inspection that the cost increase varies to a large extent. The average is 12,5% and only in one case is this increase less than 10%.

**FIGURE 5.2** presents a breakdown of costs per site for each case with the total cost per site included. Local labour wages stay reasonably constant but drop in the case of Waterkloof while in the same case the increase in other direct costs "balances" this drop. Indirect costs (*mainly consultants' fees*) are relatively low in the Bloekombos West and East cases, higher in the Millerscamp, Driftsands and Waterkloof cases and still higher in the case of Cross-Roads. This phenomenon is expected in the case of Cross-Roads as it is a small pilot project and project managers had to be funded in addition to the engineering consultant. In the Waterkloof, Driftsands and Millerscamp cases, project managers or liaison consultants were appointed and had to be funded additionally. This is, however, not the case with Bloekombos West and East where the engineering consultants

undertook community liaison. **TABLE 4.4** illustrates that it is only in the last mentioned two cases that consultants suggested additional compensation for liaison & supervision purposes. It should be noted that engineering consultants should be either complemented with consultants with expertise in community liaison, or their brief should include this function explicitly, and they should be remunerated accordingly.

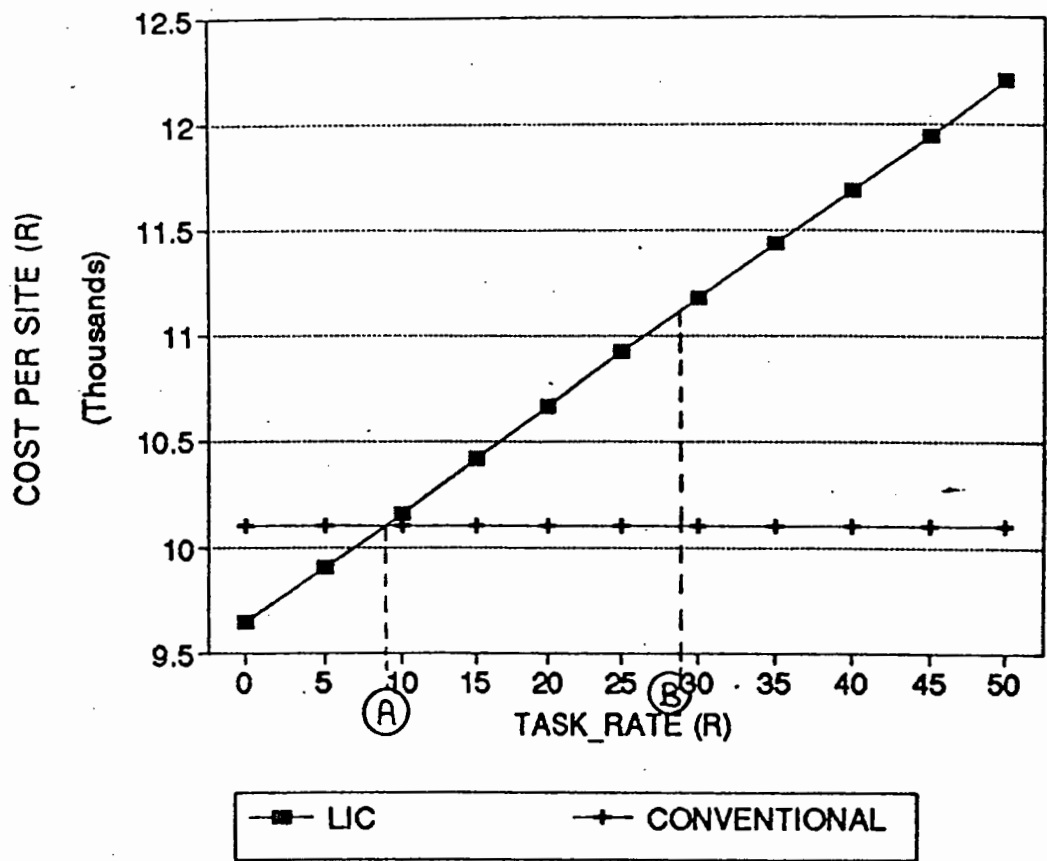


**FIGURE 5.2 BREAKDOWN OF COST PER SITE**

The principle of payment based on a task carried out has led to many labour disputes on sites and the sensitivity of the total cost to the said rate has to be investigated. **FIGURE 5.3** illustrates the effect of variations in the task-rate on the total cost for LIC and conventional methods for Driftsands. The task-rate is not applicable when conventional construction methods are used, and therefore has no effect on the cost per site. When LIC methods are employed, however,



the cost per site is directly related to the task-rate. Based on the data provided in **TABLE 4.3** for Driftsands, an increase in task-rate of R1-00 will result in an increase in cost per site of  $25\,500 \text{ (tasks)} \times \text{R1-00} / 500 \text{ (erven)} = \text{R51-00}$ .



**FIGURE 5.3 COST PER ERF/TASK-RATES FOR DRIFTSANDS.**

Point "A" can be considered as the "Financial Break-even Point" for Driftsands (with financial factors being the only consideration). Point "B", however, is the "Social Break-even Point" (accepting a "premium" of say 10% for the training benefits, distribution of welfare in the community and other social benefits). An economic analysis (considering actual economic values of inputs and outputs) falls outside the scope of this study but will be useful for effective decision-

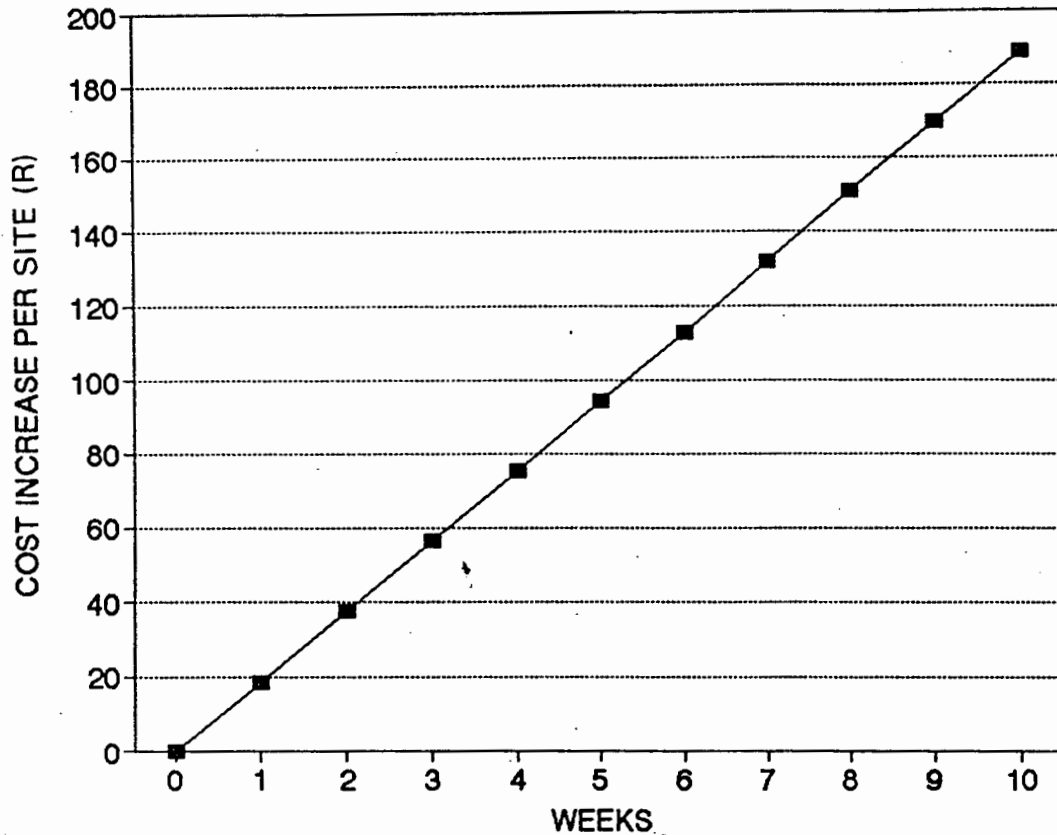
making. Such an analysis should take into account the scarcity or abundance of labour as well as the effect on the economy of drastically reducing the use of equipment. The respective values of "A" and "B" in the Driftsands case (*using the cost of conventional construction for Driftsands*) are; "A" - R8.90 "B" - R28.70 (A 20% increase in wage (or task-rate) results in a 2,3% increase in cost per erf). The values of "A" and "B" for the six cases (*using the average cost per erf for conventional construction*) are summarised in **TABLE 5.1** and figures and calculations are provided in **APPENDIX D**. The three negative values for financial break-even implies that in those three cases LIC is more costly than conventional construction, even when labourers are paid nil Rand per day. It also emphasises the need to include a "social factor" in the formula.

	FINANCIAL BREAK-EVEN POINT (A)	SOCIAL BREAK-EVEN POINT (B)
BLOEKOMBOS WEST	-2,09	16,05
BLOEKOMBOS EAST	12,26	34,20
MILLERSCAMP	-7,07	11,38
DRIFTSANDS	3,10	22,33
WATERKLOOF I & II	N/A	N/A
CROSS ROADS	-0,57	22,73

**TABLE 5.1 FINANCIAL AND SOCIAL BREAK-EVEN VALUES**

The development cost is also influenced by extensions to the contract period. Adverse weather conditions and the "external" political situation effects both construction methods in the same fashion. Extension of time resulting from labour disputes and in particular disputes surrounding the task-based payment, should be treated as affecting LIC only (with a conventional contract the contractor is solely responsible for labour issues and cannot claim extension of

time on this grounds). Taking Driftsands as example, the effect of extension of time due to labour disputes on both alternatives is illustrated in **FIGURE 5.4**



**FIGURE 5.4 EFFECT OF EXTENSION OF TIME DUE TO LABOUR DISPUTES ON THE COST PER SITE.**

An extension of time of one week leads to an increase in cost per erf of 9% of R10 923-00  $\times 7 / 365 = \text{R}19\text{-}00$ . In most instances where labour problems occurred the extension of time amounted to approximately one month resulting in a cost increase of approximately R75 per erf. This increase is relatively small, but allows for escalation only. Should contractors claim for "standing time", which they are entitled to do in circumstances where they have no control over events such as labour problems between the client and workforce, this cost could increase dramatically.

### 5.2.2 Quality

**TABLE 4.6** illustrates that quality standards are generally met and this correlates very precisely with the theory and other experience. It should, however, be noted that in the only case where road layers were spread and worked by hand, problems with this aspect of the works was experienced. Care should thus be exercised in the identification of items to be executed by hand or supervision should be enhanced.

### 5.2.3 Time

The consultants reported that they generally stipulated construction time periods similar to periods applicable to conventional projects of the same scope. Actual construction time is shortened by 4-6 weeks, because training takes place after the contractor is appointed, but prior to actual construction. The work can be expedited by employing more teams for a shorter period (*with a possible increase in supervision cost*). The financial effect of extension of time due to labour disputes has been covered, but other effects e.g. the social stability when the end product cannot be delivered in time also points to the importance of a serious consideration to time. The timing aspect thus do not deviate from the theory, but the effect of labour disputes is problematic and should be addressed.

### 5.2.4 Social Benefits

In all cases substantial amounts of money were "ploughed" into the local community by means of wages, and development through training was adequately addressed as quantified in **TABLE 4.7**. Although difficult to monitor, the security situation seems to have improved and vandalism on sites seems to have decreased. This could have been the result of involving the community and creating a sense of ownership.

### 5.2.5 Contractual Arrangement

No problems were experienced with adapted, standardised specifications and other contract documents, but there exists a need for documentation relating to employment. Where the number of tasks were not specified, tenders were evaluated with the number of tasks being one of the major criteria. This could lead to the acceptance of tenders which do not necessarily offer the lowest price and conflict with financial regulations where public funds are utilised. It also means that assessment criteria is not made available to aspirant tenderers and they are left in the dark in positioning themselves. Theory related to this aspect of LIC is not well developed and clients use various methods of evaluation.

### 5.2.6 Communication

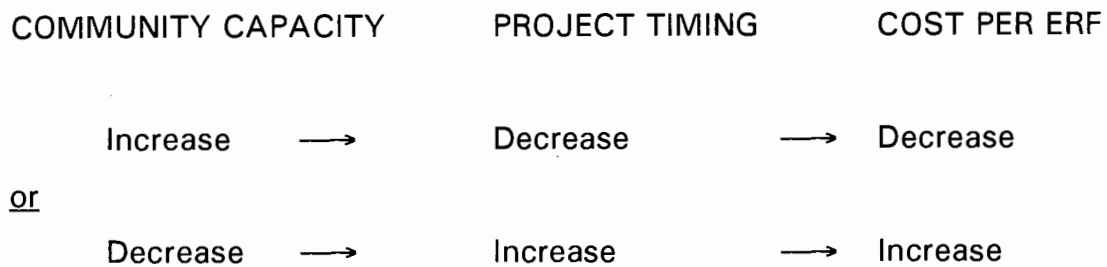
Most of the problems experienced in the six cases can be sourced to community liaison difficulties and especially the communication between developers, residents, labourers and their leaders. **TABLE 4.9** illustrates that the leadership in the Driftsands and Cross-Roads cases were well established and did not change during the course of the contract. The opposite can be said of the remaining four cases.

Synthesising the evidence in **TABLE 4.5** and **TABLE 4.9** produces the inference that only 6 days were lost due to labour problems on the Driftsands project and none at Cross-Roads. Other projects suffered at least one month's delay each, except Bloekombos West, where 16 days have been lost to date. This project is only due for completion in December 1994. It is thus safe to conclude that a well established and stable leadership should positively influence the decision to employ LIC methods.

There is no perfect recipe that can be applied to every situation to ensure successful community participation. An unique approach should be adopted for

each project, but past successes should be the basis for a strategy for new projects.

The casual links between community capacity, timing and therefore cost can be illustrated as follow:



### 5.2.7 Degree of Labour-Intensity

The extent to which activities are specified to be labour-intensive was not identified as an area to be investigated, but details of this aspect were gathered as part of the general data. As shown in **TABLE 4.3** again illustrated in **FIGURE 5.2** and discussed in chapter 4, the average labour portion of costs is 10,9%.

This figure must, however, be put into perspective. Township development projects are labour intensive to a certain extent, even in conventional form. A typical labour-intensive project specifies that excavation and backfilling for pipe-laying be done by hand, whereas the actual laying of the pipe was always done by hand. In addition to the 10,9% spent on labour in terms of task-based work, approximately 8% of the cost is allocated to permanently employed staff.

The theory suggests that up to 80% of the cost can be spent on labour. This theory is based on experience gained mainly in road construction and ,as such, is not quite compatible. The cross-case data did indicate that quality control problems occurred on the site where more than the usual items were labour-intensive and increasing the labour-intensive activities to above the current norm

could present serious problems. It can be said that an increase in LIC activities of up to, say, 11 % of total cost results in an increase in total costs, an increase in social benefits and a possible decrease in vandalism. Increasing LIC activities to above 11% of costs might have serious effects on the other factors i.e. quality and time.

### 5.3 EMPIRICAL DATA VERSUS THEORY

The following is a comparison of empirical data with the theory and summarises 5.2.1 to 5.2.7:

THEORY	CASE STUDY
The two methods can be competitive at wages between R27 and R45.	Considering the Driftsands case, the alternatives would be financially competitive at a wage of R8.90 per task and economically competitive at a wage of R28,70 per task (considering a 10% premium). In most cases, however, wages of lower than R25.00 per task need to be paid in order to contain this "premium" to 10%.
LIC cost should not be more than 10% higher than conventional construction costs.	The cost penalty is in the order of 12,5%. An increase of less than 10% is attainable, but not likely.
There should be no decrease in quality.	Quality standards are maintained when LIC portion of costs do not exceed $\pm 11\%$ .

There should be a concern for construction time.

No allowances are made for extended construction periods, but extension of time related to labour unrest periods, were claimed in four cases.

Human resource should be developed through training and attainment of skills.

Human resource are developed through training and attainment of skills.

Technical contractual procedures should be in place.

Contract documentation have been adapted to meet the requirements, however, the tender adjudication process is in many cases done in a very subjective fashion, leaving room for possible disputes, whilst not being "fair" to all parties.

Communities should be involved.

Communities are involved on all projects.

The remoteness of the project should favour LIC.

Case studies are located in the CMA where labour unions are more active, leadership less defined and expected wages higher than in rural areas.

LIC methods are technically feasible for a wide range of activities.

Township development is material intensive. The total labour portion of cost in the case of LIC is in the order of 20% of which  $\pm 11\%$  is generally local labour and the rest permanently employed staff.

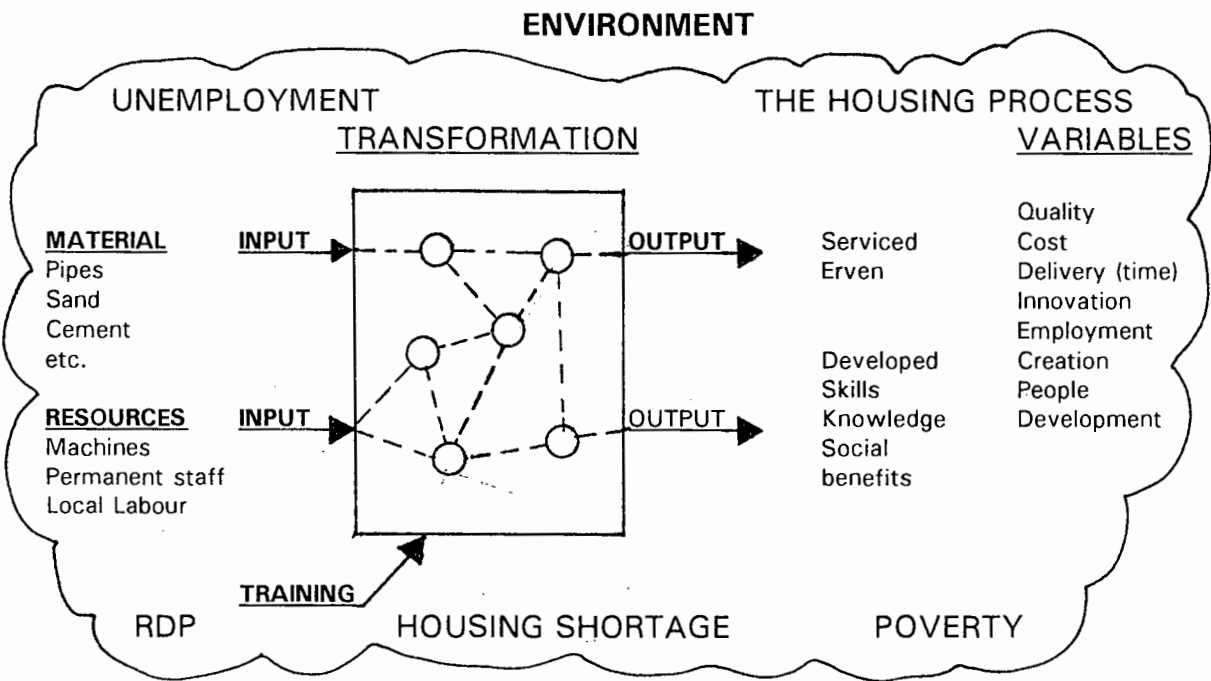


It is clear from the above summary that the case study data reinforces the general theory in some aspects of LIC, but completely differs from it in other aspects.

### 5.4 A HOLISTIC VIEW

The study followed the stated objectives and focused on each aspect of LIC and, to a certain extent, the interaction between these aspects. It is necessary to also consider the environment in which construction takes place and not only answer the question "are we doing things right" but also "are we doing the right things".

The LIC process can be modelled as an operational system - see **FIGURE 5.5**



**FIGURE 5.5 THE LABOUR INTENSIVE CONSTRUCTION PROCESS**

Township development in the CMA takes place in an environment of high UNEMPLOYMENT, the guidelines laid down for the RDP, POVERTY, a LACK OF SKILLS and a HOUSING SHORTAGE in the low-income category. While LIC fits

into the objectives of the RDP, namely to create work and provide houses, it's effect on poverty is conflicting. The positive effect of LIC is that it provides work to the poor in the short term and the transfer of skills which could provide a long term income. On the negative side of the scale, it must be recognised that most township development provides housing to the poor. Touzel <sup>[27]</sup> quotes that more than 60 percent of black households earn below R1000-00 per month. In terms of the new housing policy they therefore qualify for a once-off subsidy of R12500-00. An increase of 10% in the cost per erf due to the employment of LIC could rob the recipient of an erf of more than R1000-00. The end result is a situation where the poor subsidises the poor.

Efforts are underway to fund the difference in cost through the NEF. This intervention should ensure that the aforementioned situation does not occur.

Considering the whole LIC process as illustrated in **FIGURE 5.5**, it can be stated that material and resources are utilised and, with training inputs, transformation takes place to produce serviced erven, skilled people and social benefits. In order to comment on the viability of LIC, however, the performance of the system should be considered. Flood <sup>[28]</sup> advises that three levels of achievement be adopted:

- |              |   |   |
|--------------|---|---|
| Actuality    | - | current achievement with existing resources.                                      |
| Capability   | - | possible achievement using existing resources within existing constraints.        |
| Potentiality | - | what could be achieved by removing existing constraints and developing resources. |

Considering the fact that LIC is still in its infancy in the CMA, it can be stated that current performance is such that full capability has not been reached. Through continued development of resources and removal of constraints (e.g. the allowance of alternative specifications and quality standards in tender documents) the potential of LIC could be fully exploited.

The economic upliftment of the recipient community will need to be monitored over a period of time to determine longer term effects. The continuity of projects and the fact that untrained labourers are employed on each new project, are factors which need to be considered in long term planning.

## 6. CONCLUSION

The analysed results produced a complex set of inter-related "outcomes". Conclusions will be listed and then synthesised into solid arguments and "grey" areas respectively. Conclusions to be reached from the analysis are as follows:

- The process is largely driven by technical people and technical issues have been and are, adequately dealt with. Contractual arrangements, construction time and quality are being dealt with by technical experts. The one technical aspect, however, which still needs to be addressed is the tender evaluation and adjudication process which is very subjective and can be unfair if contractors cannot clearly determine the selection criteria.
- The viability of LIC depends on economic, technical and social issues. In order for LIC to succeed, a systems approach addressing all three aspects must be followed. To adequately address one or two of the aspects will not guarantee success.
- LIC in the CMA is a very "young" concept and all parties - client, consultant, contractor and the community - are on a learning curve. It can be expected that productivity will increase in time, but at the same time demands for higher wages and increased supervisory and liaison costs could counter any benefits.
- Township development utilising LIC in the CMA is approximately 12,5% more expensive than when conventional construction methods are used. The 10% "socially justifiable" figure quoted by many authorities does not seem to have any scientific basis. The Central Economic Advisory Service in their unpublished "Manual for Cost-benefit Analysis in South Africa"

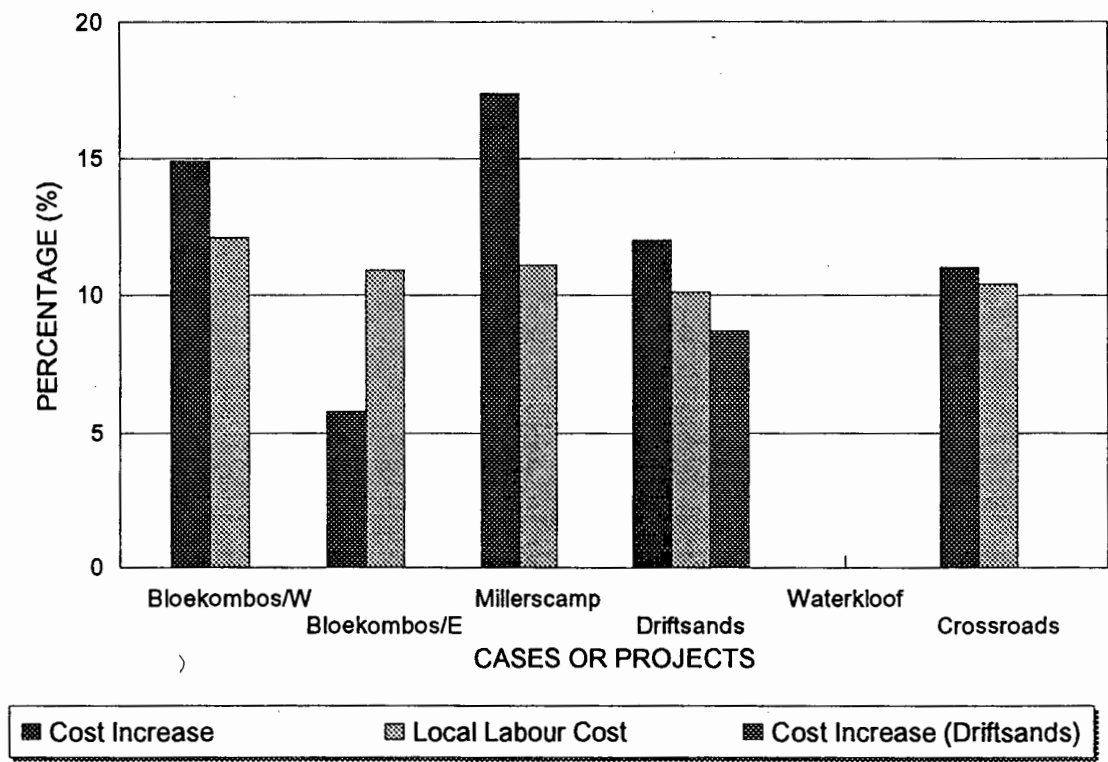
recognises a need for a "social analysis" of projects and comments as follow:

"With the help of this analysis the consequences of a project for the distribution of welfare in the community can be analysed and an evaluation can also be made of the effects of other social factors such as security, equity and the aesthetic values of the community. This analysis is best performed if government gives an indication for the relative value that is attached to different groups and social factors in the economy". Considering various factors e.g. unemployment, poverty, etc. a value for the allowable increase in costs could be allocated to demographic areas.

- The success of a LIC project (completion on time, at the tendered cost while maintaining high quality) depends to a large extent on the capacity of the local community. Do they have the potential to be trained and are they structured with a legitimate leadership or other representative body?
- Clients have specified projects to be executed with LIC methods without evaluating the options prior to briefing consultants.
- Training programs are developed to address the skill needs. A sense of ownership of projects seems to have developed in communities through involvement and are reflected in the low rate of vandalism.
- The portion of costs allocated to local labour, or the degree of labour-intensity on township development projects, is relatively small. Evidence reflects that an average of 10,9% of total costs are allocated to local labour. This figure varies between 10,1% and 12,1% (Waterkloof excluded) and while not enough evidence is available to draw concrete conclusions, indications are that an increase in LIC content could lead to a lowering in quality and increase in construction cost and time. In a recent interview with Marcus Minutelli, director of Stocks Civils (township

development), Symons <sup>[29]</sup> echoes this warning with the statement; "There are certain types of work where the premium one pays for taking the labour intensive route is not as high as it would be in other areas. This is not financially feasible when you bring the roads aspect into it, unless you are prepared to pay a huge premium for doing the work on a labour intensive basis".

The amount allocated to local labour is thus of the same order of magnitude as the difference in cost between the two methods of construction and in most cases even lower. Using an average cost for conventional construction methods, **FIGURE 6.1** illustrates the situation for each case, except Waterkloof where only 3,1% of costs are allocated to local labour. The Driftsands case includes the increase of cost over conventional construction for that specific case.

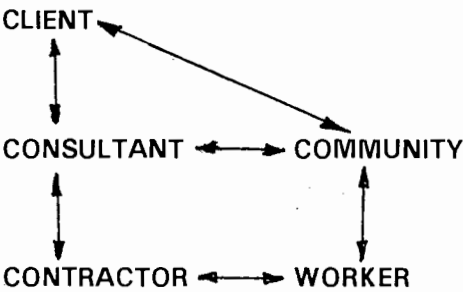


**FIGURE 6.1 CONVENTIONAL VERSUS LIC: COST INCREASE & LOCAL LABOUR PORTION OF COSTS**

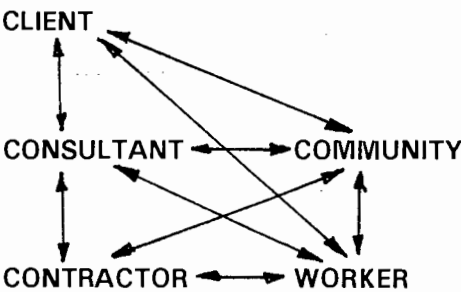
This is one aspect of LIC where the collected evidence differs widely from the theory. If the LIC content of a project causes an increase in costs equal or higher than the amount spent on training and wages, then a LIC project is definitely not viable. The project could then be constructed with conventional methods and the additional funds channelled to the community without anyone being involved in any manual labour!

- Task rates are usually agreed upon by the client, community and consultant prior to commencement of a LIC project. The contractor, who was traditionally responsible for all labour relations issues, now "inherits" a situation which he has to manage. In most cases community leaders do not even pass information on to potential workers. The contractors have obtained vast experience over many years in dealing with labour and production issues. This experience is lost to the project team when task rates are pre-determined and specified in the contract documentation. A further problem which arises is the fact that wage disputes now involves all parties. The consultants, Hill Kaplan Scott Law Gibb illustrates the "fouling" of the line of communication on site as follows:

**CORRECT COMMUNICATION**



**"PROBLEM CAUSING" COMMUNICATION**



In general there exist a strong will amongst all parties to ensure that LIC is established in the CMA. In the right environment and when things are done correctly and at a certain production level, LIC could be a viable option for township development in the CMA. In cases where the following conditions exist, it is unlikely that LIC will be successful:

Where the community leadership is not well defined and established and any element of conflict exists.

Where all parties are not fully committed and the contractor is claim conscious.

Where unemployment is not a serious problem.

Where no alternative funding is available for the increase in costs so that housing is not made less affordable.

Where soil conditions prohibits the effective use of hand excavation.

In the past years, those involved in LIC have focussed on making it work. Many procedures have been established and guidelines produced. It is, however, necessary to ensure that the right things are done. We need to ensure that funds and other resources are utilised effectively and that we are solving problems in the long run. When LIC is not a viable option it should not be implemented only because it seems to be the right thing to do.



## **7. RECOMMENDATION AND IMPLEMENTATION**

### **7.1 GENERAL RECOMMENDATIONS FOR IMPLEMENTATION**

#### **7.1.1 Monitoring: a dynamic feedback mechanism**

A monitoring system, identified as a need in many papers covered during the literature study, should be implemented. Very few consultants or project managers produce reports on completion of projects. A report covering the various aspects of LIC following a fixed framework e.g. answering the protocol questions in the study design, would make a valuable input to a monitoring system. The summarised data could assist decision-making and allow continued adjustment to the LIC process.

#### **7.1.2 The pre-feasibility report**

A pre-feasibility study should be undertaken for each identified project. The National Housing Board now requires a social compact to be formed with local communities when applications for funds are submitted and interaction with the community at this early stage has thus become essential. Such a study should include a technical, economical and social evaluation. The recommendations of this pre-feasibility report could be in favour or against the employment of LIC methods, but should also evaluate a "mixed" use of machines and manual labour. Pintusewitz et al <sup>[30]</sup> introduces a "Choice of Technique Analysis" (see **APPENDIX E** for a schematic representation).

An essential input to the pre-feasibility report is a quantification of the social benefits and the government should urgently indicate the value of social factors relevant to LIC. The capacity of the local community is also an obvious input.

Technical inputs include a description of the topography which would determine the depth of trenches and soil conditions to provide an indication whether hand excavation would be feasible.

### **7.1.3 Degree of labour-intensity**

The low degree of labour-intensity is the one single factor which seriously challenges the viability of LIC in the CMA. It was mentioned earlier that in some cases the funds spent on training and wages of local labourers was exceeded by the "premium" paid for the LIC contract. The paper "An Introduction to Choice of Technique Analysis" mentioned in 7.1.2 makes recommendation for increasing the degree of labour-intensity. Road construction and surfacing are areas which should be investigated for increasing the degree of labour-intensity in township development.

An increase in labour-intensity should be accompanied by a small or no increase in cost while quality and time should not be effected if LIC is to replace conventional methods on a viable basis.

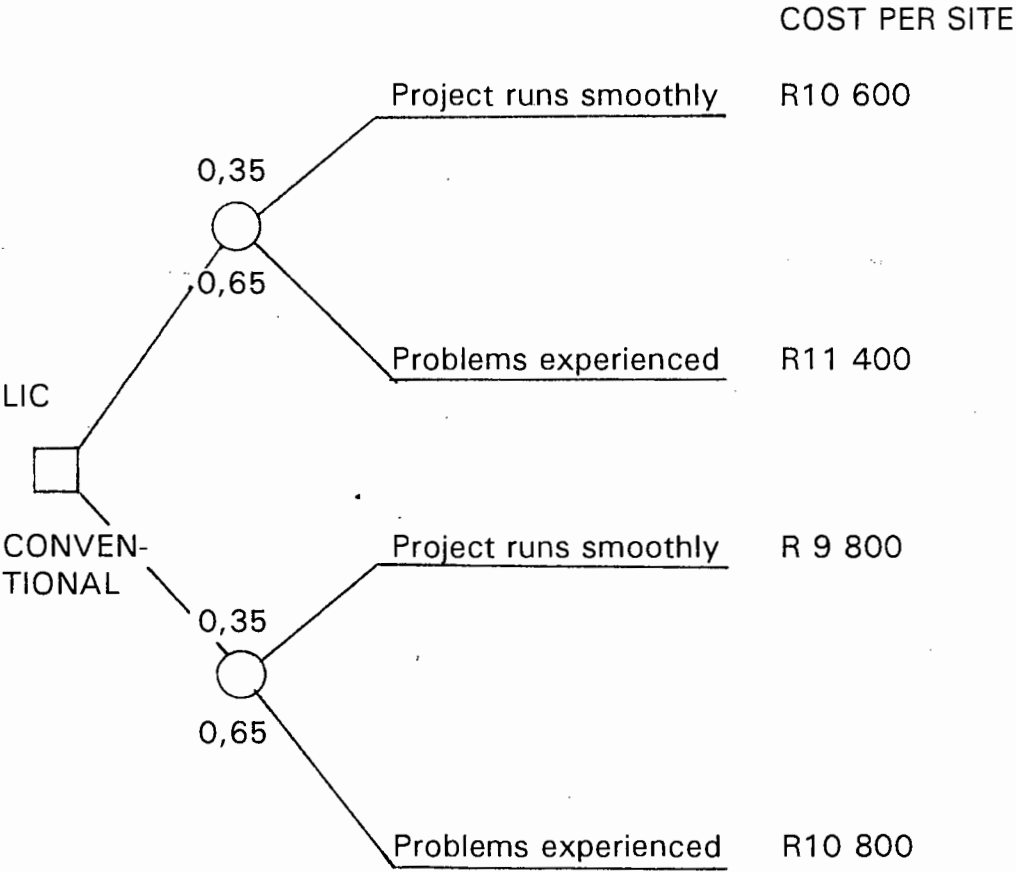
### **7.1.4 Tender Evaluation and Adjudication**

Where the pre-feasibility report will make recommendations based on general data and data collected from previous contracts in the same area, the contents of tenders enable the decision-makers to evaluate current data and ensure that the most viable option is chosen. The conventional construction method remains an excellent norm against which to evaluate the feasibility of LIC contracts and the tender documents should include a specification which covers both.

In order to remove all subjectiveness from the tender evaluation and adjudication process, Lingeletu West City Council recently appointed the firm GFJ inc. to

investigate a process where tenderers are benefitted to a certain extent for specifying more person-tasks and penalised when less than the target number is specified. This work is in progress, but an overview of the aspects covered to date is presented in **APPENDIX F**.

Decision theory can be a handy tool, utilising the findings of a pre-feasibility study and combining it with the alternative tender results. This combination of "hard" and "soft" factors can produce a decision tree illustrated in **FIGURÉ 7.1** in it's simplest form with arbitrary data. The cost per site can be calculated from the tendered bill of quantities and assuming the number of "standing days".



**FIGURE 7.1 DECISION TREE-CHOOSING THE CORRECT METHOD**

By "folding back" - multiplying costs with probabilities - the expected costs are obtained. In this case the expected cost for LIC is R11 120 and for conventional methods R10 450. Quantification of the "social factor" will allow a meaningful decision to be made. The decision tree can be expanded to cater for different "mixes" of the two methods while the sensitivity of various variables should also be investigated.

#### **7.1.5 Community Liaison**

Some engineering consultants suggest that their fees should be reviewed when they are appointed on LIC projects, while others accept that they cut profits while they are on a learning curve, but will also demand additional fees later. These claims mainly revolve around their involvement in community liaison and labour relations. It can be argued that the engineering consultant is not an expert in either of these fields and while community liaison should be undertaken by an expert with a social background, labour relations, should be handled by the contractor who is the employer of the local labour. It should remain the contractor's choice to directly employ local labour or to make use of sub-contractors.

The involvement of the client and consultant in labour issues often revolves around the task-rate which is normally determined before the contractor starts on site. This issue should be comprehensively addressed with the community during the pre-feasibility study.

#### **7.1.6 Wage rates**

Task rates and tasks should not be specified in tender documents. All communication related to wages and production should be handled by the contractor. The specification could, however, specify that a certain minimum

quantity of work be made available to local labourers. This could be achieved through the appointment of local sub-contractor or direct employment.

## **7.2 KHAYELITSHA: RECOMMENDATIONS FOR IMPLEMENTATION.**

While the above measures is essential to ensure viable township development in the CMA, a holistic approach to development in a specific area could ensure that optimal use is made of both construction methods.

Traditionally, the process of township development entailed the installation of bulk services over a wide area with smaller projects addressing the internal services and toilet structures. With the new Housing Scheme in place a "top structure" or house now also becomes part of the development.

In Khayelitsha unemployment figures are high while large amounts are spent on development. The area is, however, unstable from a political viewpoint and a considerable effort is required to involve the community in short-term projects and this effort should rather be channelled into long-term projects to ensure that maximum benefits are reaped.

Sand is abundantly available in Khayelitsha, while the high water table or the Kuilsriver provides water at no cost. In this environment precast concrete elements can be produced at competitive costs. Many local residents have started producing building blocks and other precast elements. This initiative could be built upon with the required technical, business and other skills and supported by ensuring that development in Khayelitsha consume the local products.

Another possibility is the omission of sidewalks, stabilisation of road verges and top structures from projects. Teams using labour-intensive methods then make interlocking blocks, prepare the road verges and undertake the paving. The same

concept can apply to top structures. This exercise do not need to be synchronised with the main thrust of development as the verges can remain unpaved even after residents take possession of erven. The established areas should also be addressed and the cost of maintenance (removing sand from stormwater catchpits and pipes where it eventually ends up over a number of months) could be discounted against the cost of paving.

Many other possibilities for LIC will open up as communities mobilise themselves, skills are attained and innovative efforts are ploughed into township development.

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## **APPENDIX A**

### **CASE STUDY METHOD**

**Refer to section 3.2**

## → RESEARCH DESIGN ↔ DESIGN TESTS

### COMPONENTS:

- Study's Questions
- It's Proposals
- Unit of Analysis
- Logic linking of data to propositions
- Criteria for interpreting the findings

### TYPES:

- Construct Validity
- Internal Validity
- External Validity
- Reliability

## → CASE STUDY DESIGNS ↔ CASE STUDY PROTOCOL

	Single-case Designs	Multiple-case Designs
Holistic	TYPE 1	TYPE 3
Embedded	TYPE 2	TYPE 4

- Objectives and issues
- Field procedure
- Case study questions
- Guide for case study report

## → DATA COLLECTION ↔ SOURCES OF EVIDENCE

### STUDY PROTOCOL:

- Question posed to Investigator
- Questions accompanied by list of sources

- Documentation
- Records
- Observations
- Participant-observation
- Physical Artifacts

### THREE PRINCIPLES:

- Using multiple sources
- Data Base
- Maintain chain of Evidence

## → ANALYSING EVIDENCE

### GENERAL STRATEGIES:

- Relying on theoretical propositions
- Developing a case description

### DOMINANT MODES OF ANALYSIS:

- Pattern-matching
- Explanation Building
- Time-series analysis

## → COMPOSING THE CASE STUDY REPORT

- Linear-analytic
- Comparative
- Chronological
- "Suspense"
- Unsequenced

## **APPENDIX B**

### **CASE STUDY QUESTIONS**

**The case study design, described in section 3.2.1, calls for a set of questions, based on the objectives of the study, to lead an investigator through the data gathering process. The questions are addressed with data gathered through interviews, scrutinising of documents and other sources of evidence.**

## **CASE STUDY QUESTIONS**

From 1.2 the study's aim and objectives are listed as follows:

### **GOAL or AIM:**

To determine whether Labour Intensive Construction is a viable alternative to conventional township development methods in the execution of public works in the Cape Metropolitan Area.

### **STUDY'S OBJECTIVES:**

- 1) To identify and determine the long and short term economic implications when LIC is employed.
- 2) To determine how the timing of projects are influenced when LIC is used.
- 3) To determine whether adequate quality is maintained when LIC is employed.
- 4) To attempt to identify the social effects of LIC within communities involved in or affected by the project.
- 5) To determine whether current contractual arrangements adequately facilitate the use of LIC.
- 6) To determine whether communication between all involved parties has developed to the extent that all the objectives of LIC can be realised.
- 7) To compare the findings of objectives 1 - 3 with the industry's norms for conventional construction.
- 8) To identify problem areas in respect of LIC in the CMA and make recommendations.



## **CASE STUDY QUESTIONS:**

### **GENERAL:**

- i) Which town planning principles are applied?
- ii) What is the standard of engineering services?
- iii) Which aspects of the works are constructed with LIC methods?
- iv) Which uncontrollable factors can possibly influence the project?

### **FROM OBJECTIVE 1:**

- i) What is the total direct and indirect cost of the project and what portion of the funds are directed to the employment of labour and training ?
- ii) How are the cash flows of the consultant and contractor affected?

### **FROM OBJECTIVE 2:**

How much time is spent on design and documentation and the construction phase and is any delays experienced and what is the possible causes?

### **FROM OBJECTIVE 3:**

What standards are set in respect of quality and where those standards are not achieved what are possible reasons and is the specified quality standards relevant to the level of services provided?

### **FROM OBJECTIVE 4:**

To what extent is job opportunities provided and skills developed and is there any apparent influence on the security situation?

### **FROM OBJECTIVE 5:**

- i) Which specifications were used, were they modified and were any shortcomings experienced?
- ii) How are tenders evaluated, what criteria is used and are any problems experienced in this regard?

### **FROM OBJECTIVE 6:**

- i) How is community involvement realised?
- ii) How are industrial relations handled?

## **PROTOCOL QUESTION - General (i)**

### **WHICH TOWN PLANNING PRINCIPLES ARE APPLIED?**

*Possible sources of data:*

- Interview with the Town Planner or Engineer
- Planning Report
- Structure Plan, Sub-division and other plans.

*Sample Strategies:*

- Fill in the following:  

Number of erven	erven
Average size of erf	sq m
Type of layout	
- Describe the topography (incl. extent of earthworks covered under the contract) and the shape of the site.
- Obtain a locality plan as well as a layout plan of the site (preferably A4 size).

## **PROTOCOL QUESTION - General (ii)**

### **WHAT IS THE STANDARD OF ENGINEERING SERVICES?**

*Possible sources of data:*

- Project Manager
- Civil Engineering Consultant
- Tender Documents

*Sample Strategies:*

- Describe the level of services under the following headings:

Streets (bus routes and minor roads)

Stormwater

Sewers (ablution facilities?)

Water

Electricity  
Other

- Determine the reasoning behind the specific choice of service level.

### **PROTOCOL QUESTION - General (iii)**

#### **WHICH ASPECTS OF THE WORKS ARE CONSTRUCTED WITH LIC METHODS?**

*Possible sources of data:*

- Project Manager
- Civil Engineering Consultant
- Contract Documents

*Sample Strategies:*

- List the billed items which are executed with LIC methods.

### **PROTOCOL QUESTION - General (iv)**

#### **WHICH UNCONTROLLABLE FACTORS CAN POSSIBLY INFLUENCE THE PROJECT?**

*Possible sources of data:*

- Project manager
- Engineer
- Contractor
- Tender Documentation

*Sample Strategies:*

- Obtain from documents the description of the site, soil conditions, etc. and conduct interviews to verify the actual conditions.

## **PROTOCOL QUESTION - From Objective 1(i)**

**WHAT IS THE TOTAL DIRECT AND INDIRECT COST OF THE PROJECT AND WHAT PORTION OF THE FUNDS IS DIRECTED TO THE EMPLOYMENT OF LABOUR AND TRAINING ?**

*Possible sources of data:*

- Tender evaluation report
- Project Manager
- Engineer
- Final Cost Certificate
- Training Board

*Sample Strategies:*

- Obtain the direct and indirect costs from the final certificate. With work in process final costs can be estimated by the project manager or engineer.
- State the base date (start of contract).
- List the extent of man tasks and the payment per task.
- Calculate the total cost of the project and the cost per erf.

## **PROTOCOL QUESTION - From Objective 1(ii)**

**HOW ARE THE CASH FLOWS OF THE CONSULTANT AND CONTRACTOR AFFECTED?**

*Possible sources of data:*

- Consultant's letter of appointment
- Engineer
- Final Cost Certificate
- Contractor

*Sample Strategies:*

- On what basis is the consultant appointed and how is he remunerated ?
- Interview the consultant to find out which of his functions is affected by LIC and to what extent.
- What is the contractor's view of LIC strictly from a financial point of view?

## **PROTOCOL QUESTION - From Objective 2**

**HOW MUCH TIME IS SPENT ON DESIGN AND DOCUMENTATION AND THE CONSTRUCTION PHASE AND ARE ANY DELAYS EXPERIENCED AND WHAT ARE THE POSSIBLE CAUSES ?**

*Possible sources of data:*

- Contractor
- Consultant
- Project Manager
- Contract Documents

*Sample Strategies:*

- Interview consultant and project manager and list the relevant periods.
- Verify periods with information from documents.
- Interview consultant, project manager and contractor and list the reasons for delays from each person's perspective.

## **PROTOCOL QUESTION - From Objective 3**

**WHAT STANDARDS ARE SET IN RESPECT OF QUALITY AND WHERE THOSE STANDARDS ARE NOT ACHIEVED WHAT ARE POSSIBLE REASONS AND ARE THE SPECIFIED QUALITY STANDARDS RELEVANT TO THE LEVEL OF SERVICES PROVIDED ?**

*Possible sources of data:*

- Client
- Project Manager
- Consultant
- Contractor
- Site Documentation

*Sample Strategies:*

- Is the client satisfied with the quality of the works?
- Obtain the input of the consultant and/or project manager on the level of

quality achieved.

- Interview the contractor to obtain his viewpoint on the quality standard specified and in particular how a lowering in certain standards would influence his price.
- Obtain the training programme and the number of people trained from the consultant and/or contractor and from training schedules.
- Note the contractor's experience in respect of the security situation on site - was theft or vandalism experienced ?

## **PROTOCOL QUESTION - From Objective 4**

**TO WHAT EXTENT ARE JOB OPPORTUNITIES PROVIDED AND SKILLS DEVELOPED AND IS THERE ANY APPARENT INFLUENCE ON THE SECURITY SITUATION?**

*Possible sources of data:*

- Consultant
- Contractor
- Training schedules
- Tender report

*Sample Strategies:*

- Obtain the training programme and the number of people trained from the consultant and/or contractor and from training schedules.
- Note the contractor's experience in respect of the security situation on site - was theft or vandalism experienced?

## **PROTOCOL QUESTION - From Objective 5**

**(i) WHICH SPECIFICATIONS WERE USED, WERE THEY MODIFIED AND ARE ANY SHORTCOMINGS EXPERIENCED ?**

**(ii) HOW ARE TENDERS EVALUATED, WHAT CRITERIA IS USED AND ARE ANY PROBLEMS EXPERIENCED IN THIS REGARD ?**

*Possible sources of data:*

- Consultant
- Contractor
- Client
- Tender report
- Tender Specifications

*Sample Strategies:*

- From which documents were the specifications sourced and were there any modifications ?
- Was the client happy with the specifications and tender evaluation ?
- On what basis were tenders compared and evaluated ?
- Find out whether the contractor was fully aware of the criteria used for evaluation.

## **PROTOCOL QUESTION - From Objective 6**

**(i) HOW IS COMMUNITY INVOLVEMENT REALISED ?**

**(ii) HOW IS INDUSTRIAL RELATIONS HANDLED ?**

*Possible sources of data:*

- Consultant and Project manager
- Community Leaders
- Contractor
- Project Evaluation Report (If available)
- Site correspondence

*Sample Strategies:*

- Interview different parties to ascertain the extent to which the community

was involved and at what stages of the project (was there any liaison prior to the commencement of the project ?)

- Verify information through the scanning of attendance registers of minutes of meetings and scanning the contents of evaluation reports.
- Find out who handled industrial relations. Should the client or consultant be involved, determine whether they have the necessary skills and experience.



## **APPENDIX C**

### **INDIVIDUAL CASE REPORTS**

**Results of single cases and cross-case summary are discussed in chapter 4**

- 1 BLOEKOMBOS WEST**
- 2 BLOEKOMBOS EAST**
- 3 MILLERSCAMP**
- 4 DRIFTSANDS**
- 5 WATERKLOOF**
- 6 CROSSROADS PILOT PROJECT**

## 1 ST CASE REPORT - BLOEKOMBOS WEST

The development of Bloekombos was the first LIC project to receive ABLIC accreditation. The project comprised the development of civil engineering infrastructure and the work was geographically divided into two projects; Bloekombos West and Bloekombos East. The consultant for Bloekombos West was Wouter Engelbrecht Inc. and Haw & Inglis (Pty) Ltd was appointed as contractor. The project was managed with the Main Contractor being construction Manager, but the consultant, and to a lesser extent the client, were actively involved in labour-related issues. Following the listed objectives of the study, the case is described as follows:

### SOURCES OF DATA

- Open-ended interview with Wouter Engelbrecht of Wouter Engelbrecht Inc.
- Telephonic interview with Antony Armstrong of Haw & Inglis.
- Documents (*Kept by Wouter Engelbrecht Inc., Consulting Civil and Structural Engineers, 40 Oxford St, DURBANVILLE 7550. tel (021) 975 1718*)

Bill of quantities.

Breakdown of Consultant's costs.

Minutes of site meeting dated 27 January 1994 attended by various parties involved in LIC.

Training schedule and modules.

Breakdown of Contractor's labour rates.

Tender report

Sub-division plan of Bloekombos (Plan no. 2.179)

## **General**

Town Planning was based on the guidelines of the defunct National Housing Commission.

Extent of the development area -	38 ha
No of residential sites serviced -	1024
Average erf size	- 160 m <sup>2</sup>
Density	- 27 erven/ha

The site was rectangular in shape and soil conditions comprised mainly sand with bands of clay. The water table was less than 1 metre under natural ground level.

The site has an even slope and bulk earthworks were not included in the project.

The LIC content of the works included:

Site clearance

Roadbed preparation

Excavation, laying & backfilling of sewers

Toilet construction, including brick making and plumbing.

Excavation, laying & backfilling of water lines.

Excavation, laying & backfilling of stormwater lines.

Excavation, laying & backfilling of ducts.

Kerb and drain manufacturing and laying.

Subbase and Base - levelling of heaps.

## **Economic aspects**

The total direct cost of the project is as follows:

Preliminary & General	1 539 630.00
Other billed items	<u>6 787 558.04</u>
Sub Total	8 327 188.04
10% Contingencies	<u>832 718.80</u>
Sub Total	9 159 906.84
14% VAT	<u>1 282 386.96</u>
<b>TOTAL</b>	<b>10 442 293.80</b>

**Note:** The basis month for calculation of escalation was November 1993.

The total projected indirect costs (consultants' fees) was R1 097 800 (vat incl) or 11,56% of the tender amount. Total cost for the project thus amounted to R10 442 million + R1 098 million = R11 540 million with a resultant **cost per residential erf of R11 270.00**

The ABLIC claims that 10% of accredited projects will be funded through the NEF. Funds from this source had not been received at the time of interview (*May 1994*). The Department of Manpower also pledged R12 per person being trained. This contribution towards costs had also not materialised.

A **task rate of R25.00** was applicable and the successful tenderer offered to create **55 343 person-tasks**. The total amount to be spent on local labour employed on a task-payment basis would therefore amount to R1,384 million i.e. **±12,1%** of the total project cost.

The consultant was appointed on a percentage basis in accordance with the SAACE'S Model Form 1. His fees therefore increased proportionally should the project costs increase to accommodate LIC construction. Supervision cost was not included and direct costs were recoverable from the client. This normally included the salaries and transport costs of site personnel but in this case the

director and other senior staff were involved in numerous liaison meetings with the community and labour force and a community liaison officer was specially appointed for the duration of the contract. For liaison purposes payment was made on a time basis.

The consultant estimated that his account for additional liaison (*resulting from the LIC nature of the contract*) would amount to approximately R85 000 at the end of the 12 month contract. Although the time based payment covered the salary of the director, it was argued that he was worth more to the company should he have time to execute his normal duties (*managing the office, canvassing for new work, strategic planning, client liaison*). The community insisted on liaising with the most senior personnel whenever a crisis cropped up.

Although the consultant's total fees were, say R85 000 + 6,5% of 10% of R10,4 million = R152 600 higher than fees applicable to a conventional contract (*should a LIC contract cost 10% more*), his profits were reduced due to lost opportunities (*as explained above*) and increased expenditure due to:

- constant requests from community leaders for sponsorship of events, financial contributions to functions and transport.
- enhanced supervision to oversee the work which, unlike with a normal contract, was executed by various teams working in various locations.
- the adaption of contract documents to facilitate LIC (*a once-off exercise*).

### Timing

The project commenced in January 1994 and completion was scheduled for December 1994. The contract period was prescribed and was not adjusted when the decision was made in favour of LIC.

Local residents were trained for 4-6 weeks after the project commenced, allowing the contractor a slightly shorter period for physical construction. Isolated incidents of labour unrest had given rise to extension of time (16 days to date) being claimed by the contractor.

In general the consultant was reasonably satisfied with the progress of the project.

### **Quality**

Quality standards as laid down for civil engineering works in SABS 1200 were adhered to. These standards were not relaxed for this contract and the consultant experienced no abnormal problems in this regard to date (June 1994).

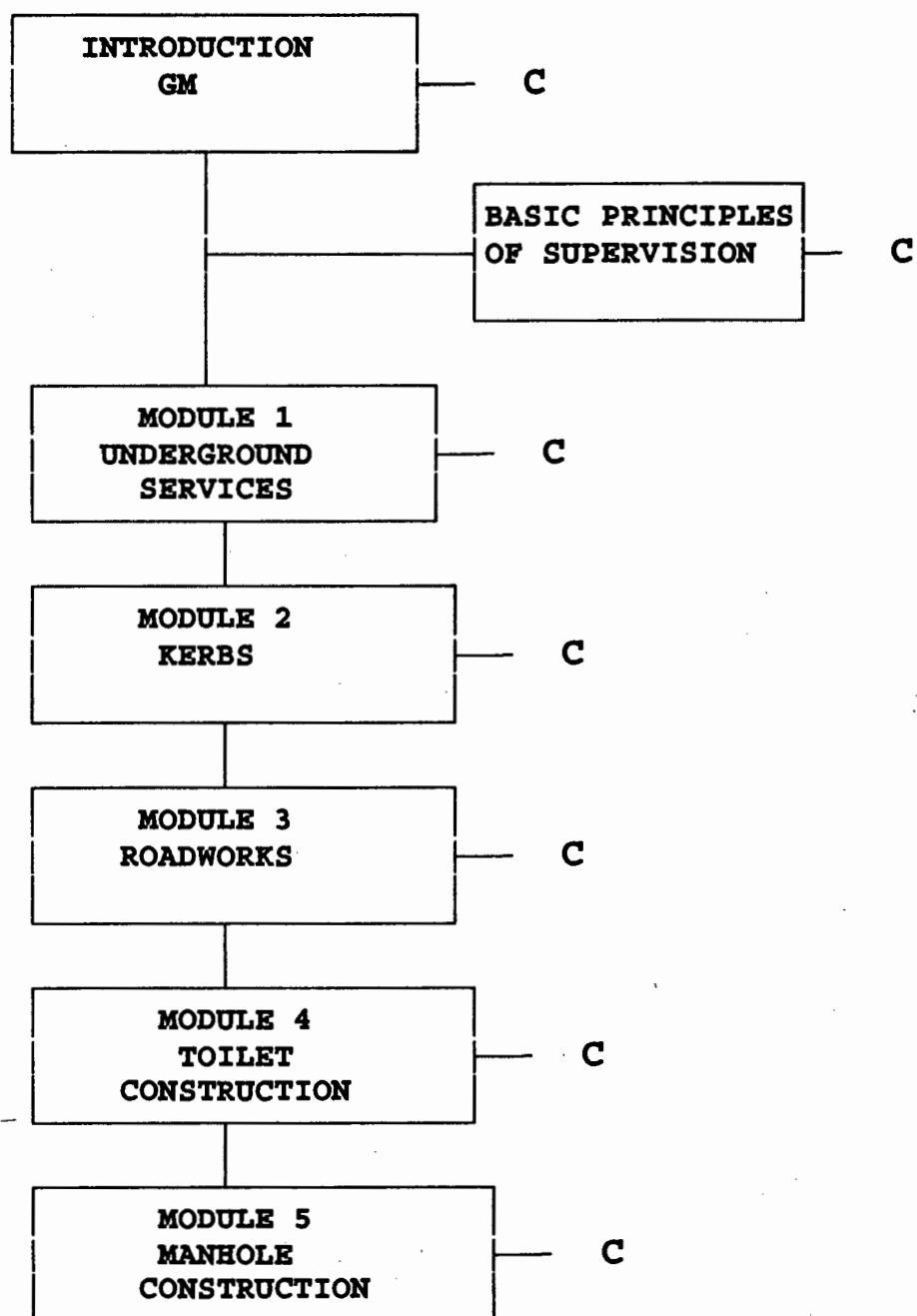
### **Social Effects**

55 343 Person-tasks are created by the project. This implies that an average of  $55\,343/12 \times 22 = 210$  previously unemployed people would be employed per month for a period of 12 months. Minutes of a site meeting conducted in May 1994 reflected that 186 workers and 23 supervisors were appointed at the time and that workers on average completed 1 1/2 tasks per day resulting in an average daily wage of  $1,5 \times R25 = R37.50$  per worker.

During the first 5 months of the contract 268 workers and 28 supervisors were trained in specific skills. The courses are approved by the Department of Manpower and certificates were issued to successful candidates. The specific courses to obtain a diploma are illustrated in **FIGURE C 1**.

Very few incidents of theft and vandalism occurred on the site and the consultant was of the opinion that the number of beggars had decreased since the start of the project.

**D**



**C** = Certificate  
**D** = Diploma

**FIGURE C 1**

**SKILLS DEVELOPMENT COURSES**

## **Contractual Arrangement**

The contractor was responsible for delivering the specified product at the quoted price and to specified standards similar to that of a conventional contract. However, the task-rate of R25.00 was negotiated with the community by the client and consultant. This arrangement entitled the contractor to claim for extension of time whenever the labour force stop work in an effort to re-negotiate the rates. The consultant reacted by drafting a disciplinary code, but the situation is not ideal.

The standardised "General Conditions of Contract" and SABS 1200 were utilised but the standard specifications were adapted and special clauses added to allow for the labour intensive nature of the contract. As mentioned earlier, additional supervision was employed to be able to monitor the work which was executed by many teams in various locations on the site.

The criteria minimum contract costs and maximum work creation were the basis of the tender evaluation and adjudication process. The successful contractor submitted the third lowest tender (*1,9% higher than the lowest tender*). However, the person-tasks submitted by him, exceeded the lowest tenderer's by 63%. The consultant used various methods to determine the optimum combination of contract costs and work creation and thereby identified the recommended tenderer. Although this ensured a measure of objectivity, there was no predefined method of comparison to guide tenderers in the bidding process. The clients "value" of the person-tasks created was not identified prior to tender opening.

## **Communication**

Additional to the normal client, consultant, contractor communication, community liaison was emphasized and was conducted in accordance with the Framework Agreement. The consultant was responsible for facilitating most of these meetings.



Industrial relations were handled by the consultant and contractor. This arrangement was far from ideal as the consultant was responsible for negotiations in respect of wages, while the contractor had set the production targets.

Communication regarding wages and other issues were mainly undertaken with leader groups. This liaison seemed inadequate as leadership changed after the start of the contract. It was also very apparent that the communication between leaders and the rest of the community was not strong enough to ensure that the correct "message" reached the local community as a whole and specifically prospective labourers.

### **Problem Identification**

The following problems were manifested in the Bloekombos West case:

- The choice to use LIC methods was not based on a sound economic/social evaluation.
- The work came to a standstill on several occasions, because of misunderstanding, industrial action and other labour related problems.
- Communication between leaders and the community as a whole.
- The tender adjudication process were not done within the framework of rigid guidelines. *(Public funds were utilised and accountability to the local community and the general public was of utmost importance).*

### **Recommendations for Improvement**

The consultant identified the following measures which could be implemented to improve the running of a LIC contract:

- The contractor should undertake all liaison relating to the employment and management of labour. All labourers should be appointed in terms of a contract clearly stipulating the terms.
- All meetings should be recorded in detail, including discussion by individuals.
- A social compact should be entered into with the community and all milestones should be "fixed" by a signed agreement.
- Visual material must be used to a larger extent to illustrate issues under discussion.
- Clients must opt for larger projects to ensure that the cost of a community liaison officer and other indirect costs can be spread over a large number of erven.
- Communication between community leaders or contact groups and the general community must be audited to ensure that the whole community could be informed at all times.

## 2ND CASE REPORT - BLOEKOMBOS EAST

Bloekombos East, adjacent to Bloekombos West, was planned to be developed simultaneously with Bloekombos West and it was only the extent of the works which led to the decision to split the work into two projects. Ninham Shand was appointed as consulting engineer and after tenders were received Graham Power Contractors was appointed to execute the work.

### Sources of Data

- Interviews with Mike Judd and Neil van Zyl of Ninham Shand.
- Documents (*Kept by Ninham Shand, 7 Hoheizen Park, Hoheizen Crescent, BELLVILLE. 7530 tel. (021) 913 5330*):

Training schedule

Tender report

Site documentation

Tender document.

- Executive summary of seminar on LIC focussing on Bloekombos - 21 July 1994 - **CAPE TOWN.**

### General

Town Planning was based on the guidelines of the defunct National Housing Commission.

Extent of development area	-	29 ha
No of residential sites	-	821
Average erf size	-	160 m <sup>2</sup>
Density	-	28 erven/ha

The site was rectangular in shape and soil conditions comprised only sand with the water table varying between 0,7 and 1,0 metres under natural ground level. Bulk earthworks and bulk services were not included in the contract. Soil from the box cuts for road construction was spread over the erven.

The *LIC content* of the works included:

- Site clearance
- Roadbed preparation
- Excavation, laying & backfilling of sewers
- Toilet construction, including brick making and plumbing.
- Excavation, laying & backfilling of water lines.
- Excavation, laying & backfilling of stormwater lines.
- Excavation, laying & backfilling of ducts.
- Kerb and drain manufacturing and laying.
- Subbase and Base - levelling of heaps.

## Economic Aspects

Direct costs of the project were as follows:

Preliminary & General	1 158 240
Other billed items	<u>4 726 133</u>
<b>Sub total</b>	<b>5 884 373</b>
Contingencies	589 880
Escalation	<u>146 000</u>
<b>Sub total</b>	<b>6 620 253</b>
VAT (14%)	<u>926 835</u>
<b>TOTAL</b>	<b>7 547 088</b>

The total consultant's fees, based on the SAACE'S Model Form 1 should amount to R545 751 plus supervision costs and disbursements estimated at R300 000.

Total projected cost for the project therefore amounted to R7,547 million + R0,846 million = R8,393 million. The total cost per residential erf amounted to R10 223.

The task rate was R25.00 and 36 700 person-tasks were offered by the lowest tenderer. This implied a spending of R0,918 million on the employment of local labour i.e. 10,9 % of the total project cost. ABLIC approval was granted but no funds had been received from this source to date. The Department of Manpower contributed R12/person/day during the training period.

According to SAACE'S Model Form 1 the consulting Engineer was entitled to a portion his fees at the stage of the project when tenders had been received and evaluated. The Engineer was of the opinion that, taking into account the additional community liaison and other consultation work, this portion of the fee should be raised with approximately 30%. The remaining portion of the fee should be raised with as much as 50% to allow for the intensive community liaison and industrial relations exercises during the construction phase. In order to adequately supervise the LIC portion of the project an additional assistant to the resident engineer was required.

During May 1994 labourers on the sites of Bloekombos West and East held the consulting engineers and contractors' staff hostage and demanded ransom amounting to R80 000. This action was based on their claim for compensation for holidays during the election period. The amount was paid over and only the cost of the time lost by each senior staff member being unable to fulfill their duties was 6 hours \* +/-R200 (according to fee scale) = R1 200.

The consultant was of the opinion that other consulting engineers, not having experience of LIC, would be willing to except an appointment for LIC based on the normal fee. However, once they had passed the learning curve they would also insist on an adjusted fee structure.

## **Timing**

The official starting date of the contract was 23 November 1993 with completion scheduled for 16 September 1994. During the first 6 months of the contract only 1 working day was lost due to inclement weather and more than 20 days due to political and labour unrest. Aspirant labourers were trained for the first 4 weeks of the contract.

## **Quality**

Quality standards were not relaxed for this project and no problems were experienced to date.

## **Social Effects**

The 36 700 person-tasks mentioned should provide a basic income to approximately 166 persons for the 10 months duration of the contract.

For training purposes a similar program to the one implemented at Bloekombos West was used. By June 1994, 258 workers and 34 supervisors had been trained in specific skills. Basic business principles were taught to 234 local residents. A "provisional sum" of R100 000 was included in the schedule of quantities of the tender document to allow for this training.

## **Contractual Arrangement**

The contractual arrangement was similar to that of the Bloekombos West site.

"General Conditions of Contract" and SABS 1200 were utilised in an adapted form. Technical specification developed by SABITA for LIC was also used. Graham Power's tender was second lowest, but his person-tasks were 60% higher than that of the lowest tender. His proposal to recruit and train labour jointly with the contractor on the adjacent site also counted in his favour.

## **Communication**

Community liaison was undertaken in accordance with the Framework Agreement. Most of this liaison and industrial relations were handled in collaboration with the adjacent contract.

## **Problem Identification**

The following problems were identified:

- Community structures were not adequately established to facilitate LIC. Communication between leader groups and the rest of the community often broke down.
- Labour disputes disrupted activities on site and were expensive and demoralised those involved in the contract.
- No criteria or evaluation guideline were available for issue to contractors at the time of tendering.

## **Recommendations for Improvement**

The following measures were recommended during interviews and discussions:

- The duties and responsibilities of each party on the site should be clearly stated, documented and be adhered to.
- An acceptable neutral body, preferably with expertise in dispute resolution and/or industrial relations should be employed on a part or full-time basis for the duration of the project.
- The first steps after a project was initialised should be to evaluate the capacity of the "target" community to determine whether LIC could be successfully employed.
- Training and the establishment of a development committee with supportive communication channels should be undertaken long before the commencement of the project.

### **3 RD CASE REPORT - MILLERSCAMP**

The upgrading of Millerscamp entailed the provision of municipal services to three squatted over areas in Nyanga. Prior to the appointment of a contractor, an area where residents could temporarily be relocated was prepared. Funds allocated by the Western Cape Regional Services Council were allocated to Ikapa Municipality for the work. Hill Kaplan Scott Inc was appointed as consultants and the tender of Haw & Inglis was accepted for the execution of the works.

The project was planned before the Framework agreement was in place and the work was specified for conventional construction methods. LIC methods. LIC methods were specified as an alternative.

#### **SOURCES OF DATA**

- Interviews with Allie Kilian (Project Engineer) and Sean Molloy of Hill Kaplan Scott Inc.
- Telephonic interview with Mr A Armstrong of Haw & Inglis.
- Discussion with Mr C Sandile of WCUSA.
- Documents (Kept by Hill Kaplan Scott Inc., 14 Kloof Street, Cape Town 8001 tel (021) 23 7050.

Tender report.

Memorandum - HKS to RB Watermeyer

Evaluation report.

Site photo album.

#### **General**

*Town Planning* was as applied to most other "low-income" developments on the Cape Flats. Apart from residential erven, 2 primary schools, crèches, churches and other erven were provided.



No of residential sites	-	446
Average erf size	-	160m <sup>2</sup>

Soil conditions comprised mainly sand with the water table 1,0 metres or less under natural ground level. Sub-surface soil conditions could not be investigated prior to the invitation for tenders as the area, at the time, was still "squatted over". During the construction phase it was discovered that a portion of the site used to be an old dumping site. Bulk earthworks were not included in the contract.

The *LIC content* of the works include:

Site clearance  
Roadbed preparation  
Excavation, laying & backfilling of sewers  
Toilet construction, including brick making and plumbing.  
Excavation, laying & backfilling of water lines.  
Excavation, laying & backfilling of stormwater lines.  
Excavation, laying & backfilling of ducts.  
Kerb and drain manufacturing and laying.  
Subbase and Base - levelling of heaps.  
Limited road surfacing

### **Economic Aspects**

Direct cost of the project is as follows:

Preliminary & General and other billed items	3 215 236
Contingencies	<u>286 360</u>
Sub Total	3 501 600
VAT (14%)	<u>490 224</u>
<b>TOTAL</b>	<b>3 991 824</b>

The consultant's fees, based on SAACE's Model Form 1 amounted to R298 770 plus supervision costs of R114 000. Disbursements, testing and settlement administration amounted to R210 000. The total cost for the project amounted to R4,615 million with a resultant cost per erf of R10 346.

The task rate was R20.00 for labourers and R30 000 for supervisors. R497 000 was spent on the employment of local labour with approximately 23 700 person-tasks created.

### **Timing**

The project commenced in October 1992 and was completed in October 1993, 3 months behind schedule. This delay was caused mostly by external factors (*political conflict in the area*) and to a lesser extent by subcontractors (*supervisors*) not paying labourers their full wages with resulting labour unrest.

### **Quality**

The contractor was able to meet the quality standards except for the road layers where patches of poorly graded material caused early failure of the road surface. This problem was probably caused by the hand preparation, possibly overworking, of the subbase and base courses.

### **Social Effects**

As mentioned earlier an amount of R497 000 was "ploughed back" into the community, generating approximately 23 700 person-tasks.

Training courses were developed during and after this project. The basic GM course was offered and other skills were obtained during on-the-job-training.

While the project was executed during a period of unrest in the area, the contractor suffered no losses due to vandalism or unrest related incidents.

## **Contractual Arrangements**

The work was put out to tender with alternatives specified by the consultant and the lowest tenderer was appointed to executed the work, using LIC methods. The work force was divided into units of 9 people, with one member being a supervisor and the rest labourers. The supervisor was appointed on a sub-contractor basis and his duty was to control and direct the team's work. He was paid per task and had to pass on payment to each labourer.

The standard contract documents were used and the tender adjudication was done according to the normal criteria, i.e. considering the tender price, previous performance, financial status and other factors.

## **Communication**

Liaison with the leaders of the target community, the client and WCUSA started in 1991. The application for funds and subsequent allocation were the result of these negotiations.

A project liaison officer, selected by the community, was appointed three months after the project had started.

The completion of the project under extremely difficult conditions was attributed by both the consultant and WCUSA to the well established communication between all parties.

## **Problem Identification**

The following problems were identified:

- At the time of planning this project, the Framework Agreement was not in place and parties in the project had to negotiate many issues from scratch.

- Whenever minor or more serious disputes arised, work was stopped, resulting in lost time and money.
- Leadership in the community changed during the construction phase with the effect that issues had to be renegotiated.
- Sub contractors had the tendency to underpay their labourers, resulting in general labour unrest.

### **Recommendations for Improvement**

- A base rate for labour should be agreed upon and documented before commencement of the project.
- An escalation clause should be coupled to the rate of payment where construction was expected to take more than, say 3 months.
- The mandate of the community leaders, i.r.o. their support by the local community should be verified beforehand and care should be exercised to ensure that the trust of the community in these leaders was not jeopardised by actions taken during the course of the project.
- Projects should not be too small, because productivity increased during the first weeks of construction as each party went through a learning curve.

## 4TH CASE REPORT - DRIFTSANDS

The community of Driftsands, together with their leader, fled from Crossroads and established themselves in the Driftsands nature reserve north of the N2 opposite Site C, Khayelitsha. It could be described as a coherent community with a strong leadership.

The Cape Provincial Administration motivated funds through the defunct National Housing Commission for the provision of services to the area. The firm BKS Inc was appointed as Project Manager, Van Wyk & Louw as Consulting Engineer and E U Civils was successful in their bid for the construction of the works and was awarded the tender.

### SOURCES OF DATA

- Interview with Schalk Vorster of BKS Inc.
- Telephonic interview with Wilhelm Meyer of E U Civils.
- Comments by Nolan Marsh of E U Civils as published in "The Civil Engineering Contractor", June 1994.
- Tender Report.

### General

**Town Planning** was are based on the guidelines of the defunct National Housing Commission.

Extent of the development area	-	20 ha
No of residential sites serviced	-	500
Average erf size	-	180 m <sup>2</sup>
Density	-	25 erven/ha

The site was rectangular in shape and soil conditions comprised sand with a high water table. Bulk earthworks and a sewer pumpstation were included in the project.

The LIC content of the works included:

- Aspects of road construction
- Excavation, laying and backfilling of sewers
- Excavation, laying and backfilling of water lines
- Excavation, laying and backfilling of stormwater lines
- Excavation, laying and backfilling of ducts
- Toilet construction, including brick making and plumbing
- Kerb and drain manufacturing and laying

**Economic aspects**

The total costs of the project (excluding all bulk and external services) were as follow:

Preliminary & General	1 576 250
Other billed items	<u>2 227 055</u>
Sub Total	3 803 305
10% Contingencies	<u>380 330</u>
Sub Total	4 183 635
14% Vat	<u>585 709</u>
<b>TOTAL</b>	<b>4 769 344</b>

Indirect costs:

Design fees	423 576
Supervision	198 000
Town Planning, Survey	200 000
Disbursements	76 600
Project Liaison Officer	22 050
Project Management	<u>199 000</u>
Sub Total	1 119 226
14% Vat	<u>156 692</u>
<b>TOTAL</b>	<b>1 275 918</b>

The indirect costs were based on all the work (including external and bulk services). The total cost for external and bulk services amounted to approximately R 1,50 million and as the indirect costs were largely based on a percentage value of the direct costs, it could be adjusted to  $R\ 1\ 275\ 918 \times 4,77/6,27 = R\ 970\ 674$  to reflect a more realistic cost with regard to internal services only.

The total cost of the project amounted to R 4,77 million + R 0,97 million = R 5,74 million or **R 11 480 per erf**. The project received ABLIC accreditation but no funds had been allocated by the NEF.

**Task rates** amounted to **R 25.00** and **25 500 person-tasks** were created by this project. The total amount spent on local labour is R 637 500 i.e. +/- 10,1 % of the total project cost (including the external services).

### Timing

The project commenced on 7 June 1993 and completion was expected to be on 29 June 1994. The planned construction period was 10 months and the additional 3 months was largely due to an unwillingness by the recipient community to relocate to sites which, in their view, were not serviced to an acceptable standard (52 days, rain days and labour problems 5½ days).

The contractor also experienced a shortage of local labourers willing to work for the prescribed wage. This was solved by employing labourers from adjacent areas, but together with the time spent on training and the application process with the Department of Manpower, this had indeed influenced the timing of the project.

### **Quality**

Quality standards as laid down in SABS 1200 were prescribed. No serious problems were experienced in this regard. Should the quality standards be lowered, the contractor's cost would decrease, but he did not foresee a dramatic lowering of tender prices.

### **Social Effects**

The project provided approximately 90 job opportunities for a duration of 13 months. An amount of R 100 000 was spent on training. The Department of Manpower contributed R 12.00 per person per day for training. The "Civil Labour Pool Worker" course was utilised.

Incidents of vandalism and/or theft were minimal. A sharp increase in incidents were however experienced after a number of labourers had to be laid off.

### **Contractual Arrangement**

The work was put out to tender with specifications based on SABS 1200 and using the standard "General Conditions of Contract". The principles tied up in the NCLIC agreement were followed and tenderers were required to submit tender amounts as well as to specify the number of person-tasks which would be created. Tenders were evaluated on, amongst others, price and employment creation, but no defined guideline was used.



The task-based payment was established in liaison between the project managers, consultants and the community before the contractor was appointed.

### **Problem Identification**

The following problems were identified:

- The decision to use LIC methods was not based on any study.
- The standard of services i.e. road widths, was not communicated to the community effectively, resulting in an unwillingness of the recipients of erven to relocate.
- The task-based method of payment presented problems.
- Although the client prescribed the amount to be coupled to a task he seldom participated in liaison with the community.
- When sub contractors were used problems were encountered with their payment of labourers. This caused delays and general labour unrest.
- Tenders were not evaluated according to a prescribed criteria or framework.

### **Recommendations for Improvement**

The following measures were identified during interviews:

- Recipient communities should be physically shown the level of services which were recommended.
- The contractor felt confident that the same product should be produced with a conventional contract in which certain aspects of the work were specified to be done by hand, should it be accepted that the work might be slightly more expensive and took longer to complete. This implied, amongst others, moving away from the task-based payment principle and adhering to the minimum wage regulations.

**5TH CASE REPORT - WATERKLOOF**

The Cape Provincial Administration motivated funds through the now defunct National Housing Commission for the provision of services to the area. The firm HKS Inc was appointed for all community liaison and Partnership De Villiers as Consulting Engineer. The contractors Clifford & Harris and EU Civils was successful with their bid for the construction of Phase I and Power Construction for Phase II of the works respectively. For the purpose of this report phase I and phase II would be considered as a single project as the available data covered the total works.

**SOURCES OF DATA**

- Interview with Allie Killian of HKS.
- Interview with Wilhelm Meyer of EU Civils.
- Interview with Eric Haughton of Partnership De Villiers.
- Tender Report.

**General**

Town Planning was based on the guidelines of the defunct National Housing Commission.

Extent of the development area	-	70 ha
No of residential sites serviced	-	1803
Average erf size	-	160 m <sup>2</sup>
Density	-	26 erven/ha

The site was rectangular in shape and soil conditions comprised mainly scale and stiff clay.

The LIC content of the works included:

Backfilling of sewers  
Backfilling of water lines  
Backfilling of stormwater lines  
Backfilling of ducts  
Toilet construction, including brick making and plumbing  
Kerb and drain manufacturing and laying

### **Economic aspects**

The total direct cost of the project (excluding all bulk and external services) was as follows:

Preliminary & General	1 502 985
Other billed items	<u>12 706 643</u>
Sub Total	14 209 628
14% Vat	<u>1 989 348</u>
TOTAL	16 198 976

Indirect costs (including VAT):

Total design & supervision fees	1 450 000
Liaison fees	<u>850 000</u>
TOTAL	2 300 000

The total cost of the project amounted to R 16,2 million + R 2,30 million = R 18,5 million or **R 10 260 per erf**. ABLIC accreditation was not applied for as the project had commenced prior to the framework agreement being in place.

Task rates amounted to **R 25.00** and **23200 person-tasks** were created by this project. The total amount spent on local labour is R 580 000 i.e. 3,1% of the total project cost.

## **Timing**

The project commenced in January 1993 and completion was scheduled for February 1994. The work was finally completed towards the end of April 1994. The delay was caused by adverse weather conditions and labour unrest. The labour unrest contributed to standing time of approximately one month.

## **Quality**

Quality standards as laid down in SABS 1200 were prescribed. No serious problems were experienced in this regard.

## **Social Effects**

The project provided approximately 80 job opportunities for a duration of 13 months.

An amount of R 32 000 was spent on training. The Western Cape Training Board assisted with training.

Incidents of vandalism and/or theft were minimal. Problems were, however, experienced during the period following Chris Hani's assassination and when higher wages were demanded towards the end of the contract.

## **Contractual Arrangement**

The work was put out to tender with specifications based on SABS 1200 and using the standard "General Conditions of Contract". The number of person-tasks was specified and the tender was adjudicated according to the normal criteria i.e. past performance of contractor, experience, financial position and tender price.

## **Communication**

All community liaison was undertaken by HKS while Partnership De Villiers acted as engineering consultants. Site meetings were generally followed by a meeting where the community was represented and their specific problems attended to.

## **Problem Identification**

The following problems were identified:

- The decision to use LIC construction methods was not based on any study.
- The task-based method of payment presented problems. Towards the end of the contract work came to a standstill and labourers were paid in accordance with the minimum wage laid down by the Department of Manpower.
- When sub-contractors were used problems were encountered with their payment of labourers. This caused delays and general labour unrest.
- The leaders with whom issues were discussed were not always representative of the community.
- Initially only WCUSA (the recipient community) was involved in discussions. It was later found that SANCO (the community living adjacent to the development area) also claimed to have a right to the area. This should have been identified prior to the start of the contract.
- Every individual was allowed to choose an erf of his/her choice. This arrangement prohibited the contractor to relocate people timeously and in groups adding to costs and lost time.

## **Recommendations for Improvement**

The following measures were identified during interviews:

- The engineering consultant should be directly involved in liaison with the community.
- Issues including the determination of the recipient community, wages and identification of potential labourers and sub-contractors should be addressed prior to the start of the contract.
- While it is essential that the community are involved in the project, "over-democratising" could be detrimental to the project. The objectives of the project should be strived for by everyone involved and inputs evaluated against it.

**6TH CASE REPORT - CROSSROADS PILOT PROJECT**

A portion of phase 4 of the upgrading of Crossroads was identified as a pilot project by Messrs BKS, the project managers for the project. The civil engineering consultant was VKE and the execution of the work was awarded to Haw & Ingles.

**SOURCES OF DATA**

- Interview with Schalk Vorster of BKS.
- Tender report.

**General**

Town Planning was based on the guidelines of the now defunct National Housing Commission.

Extent of the development area	-	4 ha
No of residential erven serviced	-	163
Average erf size	-	160 m <sup>2</sup>
Density	-	40 erven/ha

Soil conditions comprised sand with bands of calcrete of thickness up to 1,5 m at varying depth. The water table varied between the surface and 2,0 m. Bulk earthworks were completed under another contract.

The LIC content of the works included:

- Site establishment and clearing
- Toilet construction, including brickmaking and plumbing
- Precast elements

Excavation, laying and backfilling of sewers  
 Excavation, laying and backfilling of water lines  
 Excavation, laying and backfilling of stormwater lines  
 Aspects of road construction

### **Economic aspects**

The total direct cost of the project was as follows:

Preliminary & General	307 590
Other billed items	<u>725 291</u>
Sub Total	1 032 881
10% Contingencies	<u>103 288</u>
Sub Total	1 136 169
14% VAT	<u>159 064</u>
<b>TOTAL</b>	<b>1 295 233</b>

Indirect costs:

Design fees	112 302
Supervision	75 984
Town Planning, Survey	53 000
Disbursements	13 000
Project Liaison Officer	15 600
Project Management	<u>37 620</u>
Sub Total	307 506
14% VAT	<u>43 051</u>
<b>TOTAL</b>	<b>350 557</b>

The total cost of the project amounted to R 1,30 million + R 0,35 million = R 1,65 million or R 10 123 per erf. **Task rates** amounted to R 25.00 and 6 860 **person-tasks** were created. The total amount budgeted for local labour is R 171 500 i.e. 10,4% of the total project cost.



**Timing**

The project commenced on 23 March 1993 and was terminated on 21 July 1993 before completion due to the "external" political situation. There was no standing-time during the construction period.

**Quality**

No serious problems were encountered and quality standards as specified were generally met.

**Social Effects**

The project provided approximately 78 job opportunities for a duration of 4 months.

An amount of R 50 000 was spent on training.

**Contractual Arrangement**

The number of tasks were specified. The lowest tender was not accepted, because of other considerations.

**Communication**

The community involved with the project was well represented by their leadership.

**Problem Identification**

- Friction between community groups in the area presented a major obstacle.

## **Recommendations for Improvement**

The following measures were recommended during interviews and discussions:

- Constant liaison with the community is of utmost importance.

## **APPENDIX D**

### **FINANCIAL AND SOCIAL BREAK-EVEN VALUES**

**Refer to discussion in section 5.2.1**

## CALCULATION OF FINANCIAL AND ECONOMIC BREAK-EVEN VALUES

Item	Description	Information Source	Bloekombos West	Bloekombos East	Millerscamp	Driftsands		Crossroads
						LIC	Conv Constr	
1	No. of Sites	Table 4.1 (Page 28)	1024	821	446	500	500	163
2	LIC Development Cost per Site	Table 4.3 (Page 31)	11270	10376	11510	10923	N/A	10882
3	Average Conven Constr Cost per Site	Page 18	9806	9806	9806	9806	N/A	9806
4	Conven Constr Cost per Site	Page 41	N/A	N/A	N/A	N/A	10101	N/A
5	Number of Person-Tasks	Table 4.3 (Page 31)	55343	36700	23700	25500	N/A	6860
6	Rate per Task	Table 4.3 (Page 31)	25	25	25*	25	N/A	25
7	LIC Base Figure (Development Cost minus Local Labour Cost)	2 - (5*6)/1	9919	9258	11510	9648	N/A	9830
8	Value of Task-Rate when ave Conven Constr Cost is equal to LIC Cost (A)	(3-7)*1/5	-2.09	12.26	-7.07	3.10	N/A	-0.57
9	Value of Task-Rate as in 8 (allowing a 10% premium) (B)	(3*1.1-7)*1/5	16.05	34.20	11.38	22.33	N/A	22.73
10	Value of Task-Rate as in 8 for Driftsands utilising Conven Constr Cost for Driftsands	(4-7) *1/5					8.90	
11	Value of Task-Rate as in 9 for Driftsands utilising Conven Constr Cost for Driftsands	(4*1.1-7)*1/5					28.70	

\* The original task-rate was R20.00, however, the development cost were escalated to Jan '94. At that time task-rates was R25.00 in the CMA.

## **APPENDIX E**

### **CHOICE OF TECHNIQUE ANALYSIS**

**Refer to discussion in section 7.1.2**

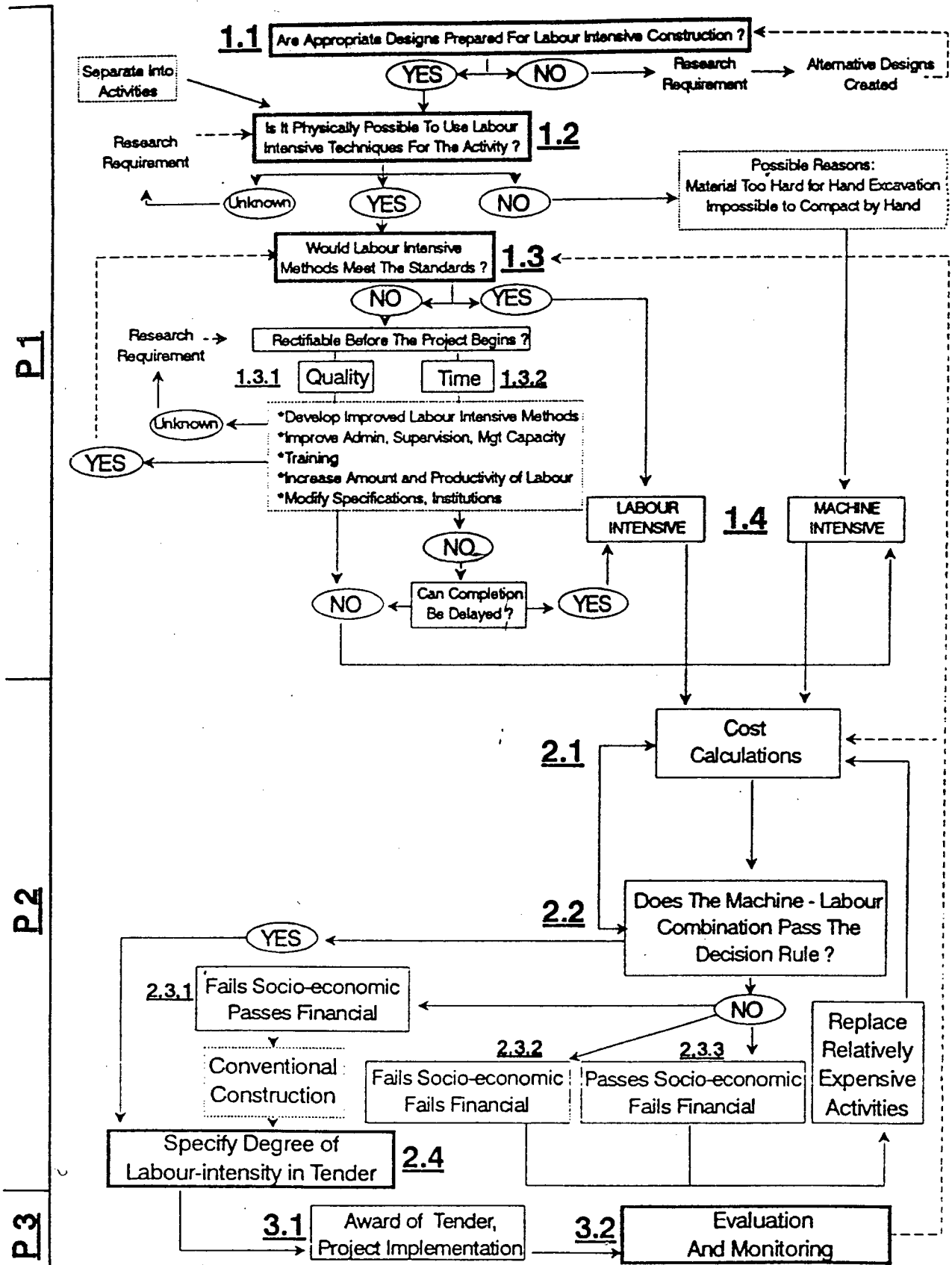
## **A. SCHEMATIC REPRESENTATION OF COTA**

A schematic representation of COTA is given overleaf. The schematic is a further development of approaches to choice of technique analysis developed by the ILO. According to the schematic, COTA is divided into three parts. The first part (P1) covers the part of the decision-making process which involves the elimination, on technical grounds, of possibilities for using labour intensive techniques for individual construction activities.

The second part (P2) covers the part of the decision-making process which involves making cost comparisons. The third part (P3) covers the part of the decision making process which involves monitoring and evaluation, or in other words, the feedback mechanism.

The rectangular blocks with solid outlines in the schematic represent identifiable steps in the decision-making process. The dotted line blocks are comment blocks. Oval shapes represent decisions. Thin arrows are used to indicate the flow of the decision-making process and thicker arrows are used to represent inputs and outputs of the cost calculations. Dotted arrows represent feedback, through new research, or the identification of quality and productivity improvements via monitoring.

# Choice Of Technique Analysis



## **APPENDIX F**

### **TENDER PREFERENCES, PENALTIES**

**&**

### **BONUSES**

**Refer to discussion in section 7.1.4**



# THE INTRODUCTION OF TENDER PREFERENCES, PENALTIES AND BONUSES TO LABOUR INTENSIVE CONSTRUCTION (LIC) CONTRACTS

*In a holistic approach to the introduction of contractual incentives to accomplish the aim of labour-based projects (conventional principal Contractor Route) the concepts of penalties, bonuses and tender preferences are propagated in this resumé. The implementation/specification of the concepts is based on the applicable minimum payment for Task Work Labour and the monetary quantification is structured according to "utility" principles in the decision analysis.*

It should be the aim of labour intensive construction (LIC) projects to afford opportunities to members of the Community to obtain employment and training. The documentation of tender and contract conditions for conventional LIC contracts (i.e. the conventional Principal Contractor Route) in a manner which allows Contractors to bid on a basis equal to all, and which simultaneously allows Engineers to enforce special conditions relating to the quantum of labour offered by a Contractor in his tender, remains, however, problematic.



In contracts for LIC methods it has become general practice to require the Tenderer/Contractor to state, as part of his tender submission, the amount of labour he proposes to employ on a contract. The quantification of the labour is to be based on person-tasks or person-days and on production rate parameters (quantity per task) for various construction

activities specified by the Engineer in the contract. The quantum of labour thus offered at tender stage becomes the contractual yardstick for the payment of penalties by the Contractor in the event of the actual employment of less person-tasks on the contract. The Tenderer is "enticed" into offering a high labour content by clauses to the effect that the extent of labour (task work) offered will be taken into consideration in the evaluation of tenders. It is argued that the abovesaid method leaves the Tenderer completely in the dark on how he can position himself in the "pricing stakes" and the specification has no "teeth" when it comes to the imposition of the said penalties.

The author believes that the answer lies in the implementation of a quantified tender preference, penalty and bonus system which takes account of the Employer's (probable) risk aversion. Apart from appropriate special conditions of Tender and Contract, pre-requisites for the application of the principles propagated would be the stipulation by the Engineer of the following in the Tender Document (only broad concepts are given due to limitations on space):

- The Minimum Daily Task Rate (R), i.e. the rate of payment for task work;
- The Bonus Qualification Amount (B), expressed in Person-Tasks, and the bonus qualification Production Rate (quantity per daily task) for various Activities;
- The Target Amount (T), expressed in Person-Tasks, for the imposition of penalties; and
- A Preference Schedule, showing the preferences to be accorded to the Tender Sum in the tender adjudication process on a percentage basis and in accordance with ranges by which the proposed offered Person-Tasks exceed the Target Amount (T).

Due to numerous subjective parameters involved, the quantification of the penalty/bonus/tender preference values stipulated for a particular project must be established in close collaboration between the Engineer and the Employer. The proof of the pudding lies in the eating, but to get the ball rolling, the following parameters seem to be realistic:

- $T = 90$  to  $80\%$  of  $B$ , below which a penalty of  $R$  per Person-Task shall be payable;
- Maximum Bonus =  $10\%$  to  $20\%$  of  $B$ , based on a sliding scale of  $100$  to (say)  $30\%$  of  $R$  per Person-Task, for an exceedance of  $B$  up to a maximum exceedance of (say)  $30\%$ . (For obvious reasons the maximum amount of bonus payable in Rand must be stipulated in the Tender, for starters an amount in the order of  $1$  to  $2\%$  of the Tender Sum is proposed.) The actual bonus could be payable out of a provisional lump sum included in the Schedule of Quantities for such purposes.

The introduction of the above penalty/bonus and tender preference concepts by GFJ recently met with great acclaim from the contracting fraternity in the Western Cape and are further illustrated in the figures below.

Alwyn du Toit

STELLENBOSCH

